

California High-Speed Train Project



Anaheim to Los Angeles Section

ALTERNATIVES ANALYSIS REPORT

Prepared by: Tyler R Bostead 4/21/09
Tyler Bostead, STV Inc. Date

Checked by: Eugene Kim 4/21/09
Eugene Kim, STV Inc Date

Reviewed by: Steven Wolf 4/21/09
Steven Wolf, Environmental Program Mgr Date

Approved by: Tony Daniels 4/22/09
Tony Daniels, Program Director Date

Released by: Dan Leavitt 4/24/09
Dan Leavitt, Deputy Director, CAHSRA Date

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ABBREVIATIONS / ACRONYMS

AA.....	Alternatives Analysis
A-LA	Anaheim to Los Angeles
Authority	California High-Speed Rail Authority
BNSF.....	Burlington Northern Santa Fe Railway
CAHST	California High-Speed Train Project
CEQA	California Environmental Quality Act
EIR	Environmental Impact Report
EIS.....	Environmental Impact Statement
FRA	Federal Railroad Administration
HSR.....	High-Speed Rail
HST	High-Speed Train
LOSSAN.....	Los Angeles to San Diego Passenger Rail Corridor
MPH	Miles per Hour
NEPA.....	National Environmental Policy Act
OC/SD.....	Orange County / San Diego
PVL.....	Perris Valley Line
ROW.....	Right-of-Way
TOD.....	Transit-Oriented Development
UP	Union Pacific

1.0 INTRODUCTION

1.1 CALIFORNIA HST PROJECT BACKGROUND

The California High-Speed Train (CAHST) Project is planned to provide intercity, high-speed train (HST) service on over 800 miles of tracks throughout California, connecting the major population centers of Sacramento, the San Francisco Bay Area, the Central Valley, Los Angeles, the Inland Empire, Orange County, and San Diego. The HST system is envisioned as a state-of-the-art, electrically powered, high-speed, steel-wheel-on-steel-rail technology, including state-of-the-art safety, signaling, and automated train-control systems. The trains will be capable of operating at speeds of up to 220 miles per hour (mph) over a fully grade separated alignment, with an expected express trip time between Los Angeles and San Francisco of 2 hours and 40 minutes.

The CAHST Project will be planned, designed, constructed, and operated under the direction of the California High-Speed Rail Authority (Authority), a nine-member state governing board formed in 1996. The Authority's statutory mandate is to develop a high-speed rail (HSR) system that is coordinated with the state's existing transportation network, including intercity rail and bus lines, regional commuter rail lines, urban rail and bus transit lines, highways, and airports.

1.2 ANAHEIM TO LOS ANGELES PROJECT EIR/EIS BACKGROUND

The Authority, in cooperation with the Federal Railroad Administration (FRA), certified the Statewide Final Program Environmental Impact Report (EIR) / Environmental Impact Statement (EIS) in November 2005, which included the identification and program-level analysis and mitigation measures for alignment and station locations throughout the State. Following a review of a range of alternatives to meet the growing demand for intercity travel in California, the HST system alternative was identified as the environmentally preferred alternative under the National Environmental Policy Act (NEPA) as well as the environmentally superior alternative under the California Environmental Quality Act (CEQA).

The Authority has initiated project-level preliminary engineering and environmental review on eight individual sections of the statewide system. It has also initiated efforts to preserve important right-of-way (ROW) parcels in HST corridors. The STV Team has been tasked to prepare a Project-Level EIR/EIS (Project EIR/EIS) for the Anaheim to Los Angeles (A-LA) section of the statewide HST system as the next tier of environmental review. The Program EIR/EIS identified the existing Los Angeles to San Diego (LOSSAN) Passenger Rail Corridor as the preferred alignment for this section, with stations at Irvine, Anaheim, Norwalk / Santa Fe Springs, and Los Angeles Union Station. Given the constrained nature of the corridor, high-speed trains will share the corridor with the other passenger rail operators in the area, which include trains run by the National Railroad Passenger Association (Amtrak) and the Southern California Regional Rail Authority (SCRRA or Metrolink). While the Program EIR/EIS identified the preferred corridor as extending from Irvine to Los Angeles, this Project EIR/EIS will only focus on the section between Anaheim and Los Angeles that is expected to be implemented initially. High-speed trains will have an estimated trip time of approximately 20 minutes between the Anaheim and Los Angeles stations, with maximum speeds approaching 125 mph. The route of the A-LA HST section is shown in Figure 1.1.

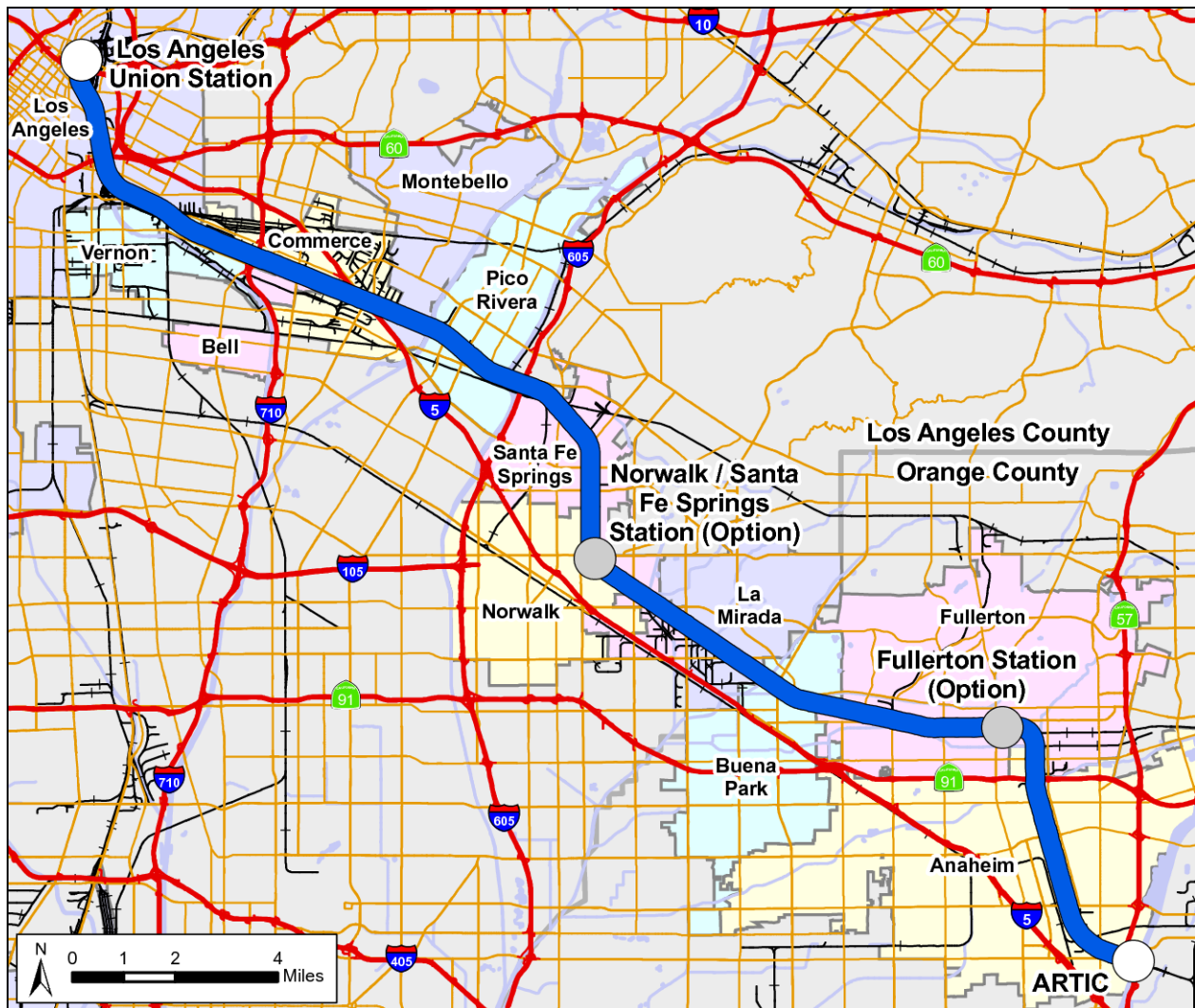
1.3 ALTERNATIVES ANALYSIS REPORT – PURPOSE AND STRUCTURE

This Alternatives Analysis (AA) Report uses preliminary planning, environmental, and engineering information to identify feasible and practicable alternatives to carry forward for environmental review and preliminary engineering design in the Anaheim to Los Angeles HST Project EIR/EIS. This report is to assist the Authority and the FRA in identifying the range of potentially feasible alternatives to analyze in the draft Project EIR/EIS. It documents the preliminary evaluation of alternatives, indicating how each of the alternatives meets the purpose for the HST project, how evaluation criteria were applied and used to determine which alternatives to carry forward for detailed environmental analysis, and which alternatives not to carry forward for further analysis.

The analysis begins with the alignment corridor selected at the conclusion of the 2005 Final Statewide Program EIR/EIS process. Public and agency comments in response to the Project EIR/EIS scoping processes and during ongoing interagency coordination meetings, and direction from the Authority and FRA were used to identify initial alternatives to carry forward for detailed environmental review. After identifying initial project alternatives, alignment plans, profiles, and cross-sections have been developed and used for this preliminary evaluation of the alternatives.

Section 2.0 describes the evaluation measures used in this report for a preliminary review of potential alignment and station alternatives. Each of the project alternatives is described in detail in Section 3.0, and the section concludes that only a dedicated HST alternative would meet the HST capacity needs and operational objectives. Section 4.0 divides the corridor into sub-sections, and analyzes areas where more than one dedicated HST option is available. Section 5.0 summarizes the results of this report.

Figure 1.1. Route and Station Locations Anaheim to Los Angeles HST Section



Source: AE LLC, STV Incorporated

2.0 EVALUATION MEASURES

The system performance criteria used in this report to evaluate and compare project alternatives are taken from the *Alternatives Analysis Methods for Project-Level EIR/EIS Technical Memorandum* dated December 2, 2008 (included in Appendix A). The evaluation measures encompass both system performance criteria and alternatives analysis measures that are commonly used in evaluating project alternatives for passenger rail projects.

2.1 HST DESIGN OBJECTIVES

Project alternatives are evaluated using system performance criteria that address design differences and qualities. Alignment and station performance objectives and criteria are described in Table 2.1.

Table 2.1. Alignment and Station Performance Objectives and Criteria

Objective	Criteria
Maximize ridership/revenue potential	<ul style="list-style-type: none">• Travel time• Route length
Maximize connectivity and accessibility	<ul style="list-style-type: none">• Intermodal connections
Minimize operating and capital costs	<ul style="list-style-type: none">• Construction, operations and maintenance issues and costs

Source: CAHST Alternatives Analysis Methods for Project EIR/EIS

2.2 PRELIMINARY ALTERNATIVES ANALYSIS CRITERIA

In addition to the HST objectives and criteria above, measures to evaluate and compare the project alternatives are described in Table 2.2. Where it is possible to quantify the measure, estimates are provided, and where it is not possible to quantify effects, qualitative assessments are provided.

Table 2.2. HST Alternatives Analysis Evaluation Measures

Measurement	Method	Source
A. Land use supports transit use and is consistent with existing, adopted local, regional and state plans, and is supported by existing or future growth areas as measured by:		
Development potential for Transit Oriented Development (TOD) within walking distance of station	Sites within ½-mile of station compare potential of different station sites; note locations(s) with highest potential for TOD development.	Regional and local planning documents and land use analysis and input from local planning agencies
Consistency with other planning efforts and adopted plans	Qualitative – General analysis of applicable planning and policy documents	Land use analysis and input from planning agencies – utilize approved land use plans and maps obtained from the jurisdictions along the HST corridor, and conduct interviews with City and County planning staffs to evaluate the HST consistency with adjacent land uses
B. Maximize ridership/revenue potential by:		

Measurement	Method	Source
Reliability of Operation	Qualitative – Reliability of service will impact ridership	Review operational characteristics and reliability issues of the alternatives
C. Construction of the alternative is feasible in terms of engineering challenges and right-of-way constraints as measured by:		
Constructability, access for construction; within existing transportation ROW	Extent of feasible access to alignment for construction	Plans and maps
D. Minimize disruptions to neighborhoods and communities – extent to which an alternative minimizes right-of-way acquisitions, minimizes dividing an established community and minimizes conflicts with community resources as measured by:		
Displacements	Number of residences and businesses displaced, size of properties and magnitude of property value of displaced (ranked as least, most # displaced; # acres)	Identified using concept drawings and aerial photographs
Properties with Access Affected	Number of properties whose access would be permanently disrupted # of properties disrupted by construction	Estimated off concept plans and aerial photographs
Local Traffic Effects around stations	Potential increase in traffic congestion or LOS at critical intersections	Local jurisdiction general plan, specific/area plans, and regional transportation plans. Existing traffic LOS from local jurisdictions
E. Minimize impacts to environmental resources – extent to which an alternative minimizes impacts on natural resources as measured by:		
Waterways and wetlands and nature preserves or biologically sensitive habitat areas affected	Number of new bridge crossings required; rough estimate of acres of wetlands; linear feet of waterways; acres and species of Threatened & Endangered habitat affected; acres of natural areas affected.	Utilize applicable City and County General Plans to identify areas that may qualify as potential waters of the United States. Quantify jurisdictional areas and include a breakdown of wetlands, non-wetland waters of the U.S., waters of the State, and other special aquatic resources discovered within the study area. Records search of the California Natural Diversity Database and the California Native Plant Society Inventory of Rare and Endangered Plants of California. Review of Habitat Conservation Plans within the study area.

Measurement	Method	Source
Cultural Resources	Number and type of historic architectural properties and archaeological sites directly impacted	Based on information contained at the Regional Centers of the California Historical Resources Information System, as well as local historical societies, libraries, and other historic resource repositories. Review of environmental documents already prepared within the study area.
Parklands	Number of acres of wildlife refuges and parks directly and indirectly affected	Based on reviews of aerial photographs and land use plans and maps from jurisdictions along the HST corridor.
Agricultural lands	Acres of prime farmland, farmland of statewide importance, unique farmland, and farmland of local importance within preliminary limits of disturbance	Based on reviews of aerial photographs and land use plans and maps from jurisdictions along the HST corridor, there are no agricultural lands within the A-LA HST corridor study area.
F. Minimize impacts to environmental resources – extent to which an alternative minimizes impacts on resources as measured by:		
Noise/Vibration effects on sensitive receptors	Identify number of and types of noise sensitive receptors near the HST corridor and model project noise levels and vibration levels above FRA impact threshold	Based on screening level assessment: inventory of potential sensitive receptors from site survey and aerial maps, Local / Regional study reports (i.e., SCAG, Land Use Elements / Maps), Local Noise Elements / Background Reports, FTA <i>Transit Noise and Vibration Impact Assessment</i> Guidance Manual, May 2006, FRA <i>High-Speed Ground Transportation Noise and Vibration Impact Assessment</i> Guidance Manual, October 2005 (FRA Manual), FRA Manual, Chapter 8 (General Vibration Assessment), and FRA Manual, Chapter 9 (Detailed Vibration Assessment).

Measurement	Method	Source
Change in visual / scenic resources	Number of view corridors and scenic/visual resources affected; extent of elevated structures in scenic areas and shadows on sensitive resources (parks)	Based on general assessment survey of alignment corridor. Federal Highway Administration (FHWA) Visual Impact Assessment of Highway Projects. Caltrans Standard Environmental Reference, Environmental Handbook Volume 1, Chapter 27 – Visual and Aesthetic Review. General plans, specific plans, redevelopment plans, public lands plans, etc. for references to important visual or scenic resources.
Maximize avoidance of areas with geologic and soils constraints	Soils/slope constraints Seismic constraints (proximity to earthquake zones)	Based on USGS topographic maps.
Maximize avoidance of areas with potential hazardous materials	Hazardous materials/waste constraints	Based on EDR Report. Historic and current aerial photographs, minimum of decade service from date of first readily available, historic and current topographic maps, current land use maps from general plans within project area jurisdictions, and Site Reconnaissance - visual survey of current development and uses obtained by viewing project area from publicly accessible locations.

Source: CAHST Alternatives Analysis Methods for Project EIR/EIS

2.3 IDENTIFICATION OF ALTERNATIVES TO BE ELIMINATED / CARRIED FORWARD

The main objectives of this document are to document the evaluation process used to identify reasonable and feasible project alternatives, and to identify those alternatives where environmental issues (severe conflicts or constraints) or engineering constraints justify dropping them from further analysis.

Alternatives are dropped from further consideration if they are not reasonable, practicable, and feasible.

Major issues that could qualify an alternative to be dropped include:

- Alternative has environmental or engineering issues that would make approvals or implementation infeasible.
- Alternative does not reduce or avoid adverse environmental impacts.
- Alternative does not meet purpose and project objectives in providing a sustainable reduction in travel time between major urban centers.
- Alternative is not feasible or practicable to construct.

Issues that justify an alternative being eliminated are highlighted in each comparative table. Alternatives to be carried forward / eliminated are summarized at the end of each section.

3.0 PROJECT ALTERNATIVES

3.1 DEVELOPMENT OF ALTERNATIVES

The alignment corridor and station options selected by the Authority and FRA with the Statewide Program EIR/EIS were the basis for the identification of preliminary alignment alternatives and design options for this section of the HST system. The minimum design consideration for these alternatives was to add needed track capacity to the existing LOSSAN Corridor to accommodate the HST operations. From Hobart Yard to Los Angeles Union Station, where the HST alignment does not follow the LOSSAN corridor, the ROW needed to accommodate the two HST tracks and the constraints of the existing land uses determined the alignments and design options considered in the Alternatives Analysis. A discussion of the FRA regulatory issues for non-compliant HST operations on the same track as compliant freight and passenger trains is discussed in Section 3.2.

The infrastructure and alignments of the project alternatives developed for this HST Project considered for the entire alignment from the existing Anaheim Metrolink Station on the south to Los Angeles Union Station on the north are divided in subsections. Figure 3.1 shows the major subsections analyzed in this report. For each of the subsections the following alternatives were evaluated for further consideration in Sections 3.3 through 3.6 of this report:

- No Project Alternative
- Program-Level Shared-Track Alternative
- Expanded Shared-Track Alternative
- Dedicated HST Alternative

Section 3.7 includes a discussion of the operational feasibility analysis of each of the HST alternatives.

Figure 3.1. A-LA Subsection Overview



Source: AE LLC, STV Incorporated

3.1.1 Program EIR/EIS

3.1.1.1 Statewide Program EIR/EIS Alternatives

The statewide Program EIR/EIS for the CAHST was completed in November 2005. The Authority and FRA selected the technology for the HST vehicles and identified potential route and station location options through the program environmental analysis. For a more detailed examination of these issues, refer to the *California High-Speed Train Final Program EIR/EIS*.

The Program EIR/EIS examined three major alternatives for the statewide transportation network. They were:

- **No Project Alternative** – The State's transportation network as it is today, along with funded projects included in regional transportation plans.
- **Modal Alternative** – Enhancements to the State's transportation network using existing modes and technologies (mainly expanded airports and highways).
- **High-Speed Train Alternative** – A new high-speed train system to connect California's major urban centers.

The HST Alternative was selected as the preferred system alternative based on the Program EIR/EIS. The No Project Alternative was not able to provide the needed level of intercity mobility in the future, while the Modal Alternative provided reduced mobility compared to the HST Alternative. In addition, the Modal Alternative would have a higher cost than the HST Alternative, and more significant environmental impacts.

3.1.1.2 Anaheim to Los Angeles Routing and Station Alternatives

For the section of the HST project from Anaheim to Los Angeles, the Program EIR/EIS examined two general alignments. These alignments are shown in Figure 3.2, and described below:

- **LOSSAN Corridor** – Follows the existing LOSSAN corridor from Irvine to Los Angeles, with intermediate stations in Anaheim and Norwalk / Santa Fe Springs. The existing rail corridor would be upgraded with electrification, additional tracks, and grade separations at all current at-grade crossings. This corridor assumes sharing tracks with other rail modes, and is primarily at-grade between Los Angeles and Anaheim.
- **Union Pacific Santa Ana Branch Line** – Uses the LOSSAN corridor from Irvine to Anaheim, then the existing Union Pacific (UP) Santa Ana Branch Line and San Pedro Subdivision corridors from Anaheim to Los Angeles. Intermediate stations would be located at Norwalk and Anaheim. The HST tracks would be completely separated from all other rail traffic in the corridor, primarily on aerial structures or in trenches.

Using the findings from the Program EIR/EIS, the Authority and FRA selected the LOSSAN corridor as the preferred alignment for the Anaheim to Los Angeles section of CAHST Project. The Program EIR/EIS recognized that more detailed project level analysis could result in infrastructure requirements with potentially increased costs and environmental impacts. The selection of the LOSSAN alignment option was based on the assumption that the capacity and compatibility issues associated with the shared operations with existing non-electric service (Amtrak, Metrolink, and freight trains) could be resolved. While the Program EIR/EIS identified the preferred corridor as extending from Irvine to Los Angeles, this Project EIR/EIS will only focus on the section between Anaheim and Los Angeles that is expected to be implemented initially.

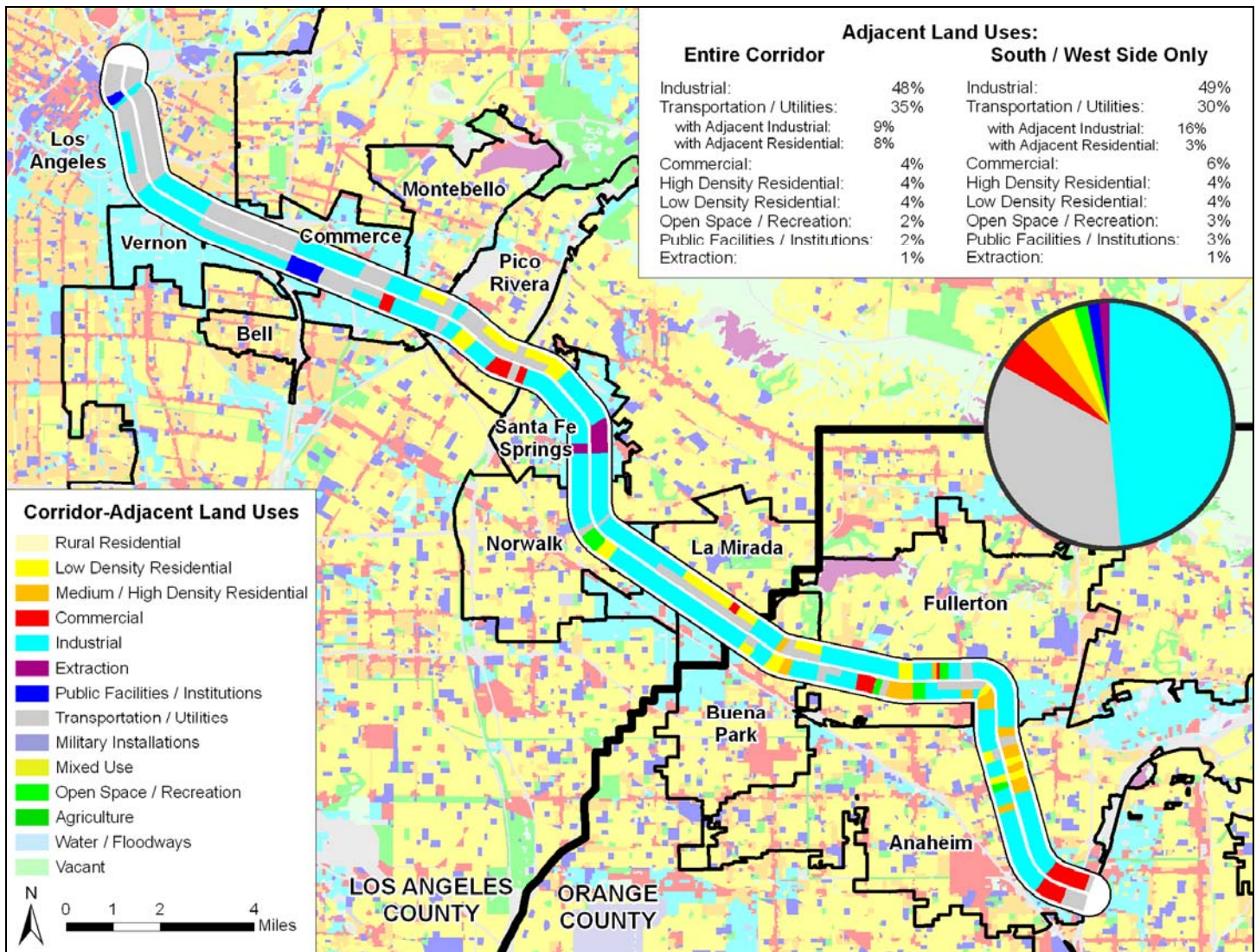
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3.1.2 LOSSAN Corridor Land Uses and Constraints

- **Residential Areas:**
 - Anaheim
 - Fullerton
 - Buena Park
 - La Mirada
 - West Whittier (Unincorporated Los Angeles County)
 - Pico Rivera
 - Montebello
- **Parks / Open Space:**
 - Citrus Park (Anaheim)
 - Amerige Park (Fullerton)

- Independence Park (Fullerton)
- Hunt Library and Dog Park (Fullerton)
- Zimmerman Park (Norwalk)
- Los Angeles River (Los Angeles) – Planned
- **Transportation**
 - Anaheim Amtrak / Metrolink Station
 - Fullerton Transportation Center
 - Walnut Avenue (Fullerton)
 - Artesia Avenue / Fullerton Municipal Airport (Fullerton)
 - Lakeside Drive (Buena Park)
 - Buena Park Metrolink Station
 - La Mirada / Santa Fe Springs Freight Rail Yards
 - Stage Road (La Mirada)
 - Norwalk / Santa Fe Springs Metrolink Station
 - Rivera Road (Pico Rivera / West Whittier)
 - Pico Rivera Freight Rail Yard
 - Sycamore Street (Montebello)
 - Commerce Metrolink Station
 - Commerce Locomotive Facility
 - Commerce Rail Yard (Auto Yard)
 - 26th Street (Vernon)
 - Hobart Rail Yard (Vernon)
 - Metro Red Line Yards / BNSF Storage Yard (Los Angeles)
 - Los Angeles Union Station

Figure 3.3. Corridor-Adjacent Land Uses along Anaheim-LA HST Section



Source: SCAG (2005), AE LLC, STV Incorporated

3.2 COMPLIANCE ISSUES FOR HST OPERATIONS

FRA is the lead federal agency for the environmental review process of the HST Project under the National Environmental Protection Act (NEPA). The FRA's primary responsibility is the promulgation and enforcement of federal safety regulations for railroads. High-speed rail vehicle technology differs significantly from equipment compliant with current FRA regulations, most notably in how the technologies address the key issue of passenger and crew safety (i.e. crash worthiness for FRA compliant vehicles vs. crash avoidance for high-speed trains). New regulations are required from the FRA that address the very high speeds planned (over 200 mph) for the HST system. The segment between Anaheim to Los Angeles is expected to operate at speeds of up to 125 mph, but will use the same equipment as the highest speed segments.

The course set out in the Program EIR/EIS is to seek a special rule from the FRA that allows the operation of compliant and non-compliant high-speed trains on the same track. With modern train control technologies such as "positive train control (PTC)," which assures train separation (crash avoidance) by means of special wayside and onboard equipment, conflicts among the different operators in the corridor can be prevented. Based on proven performance of PTC technologies on other rail system, a waiver

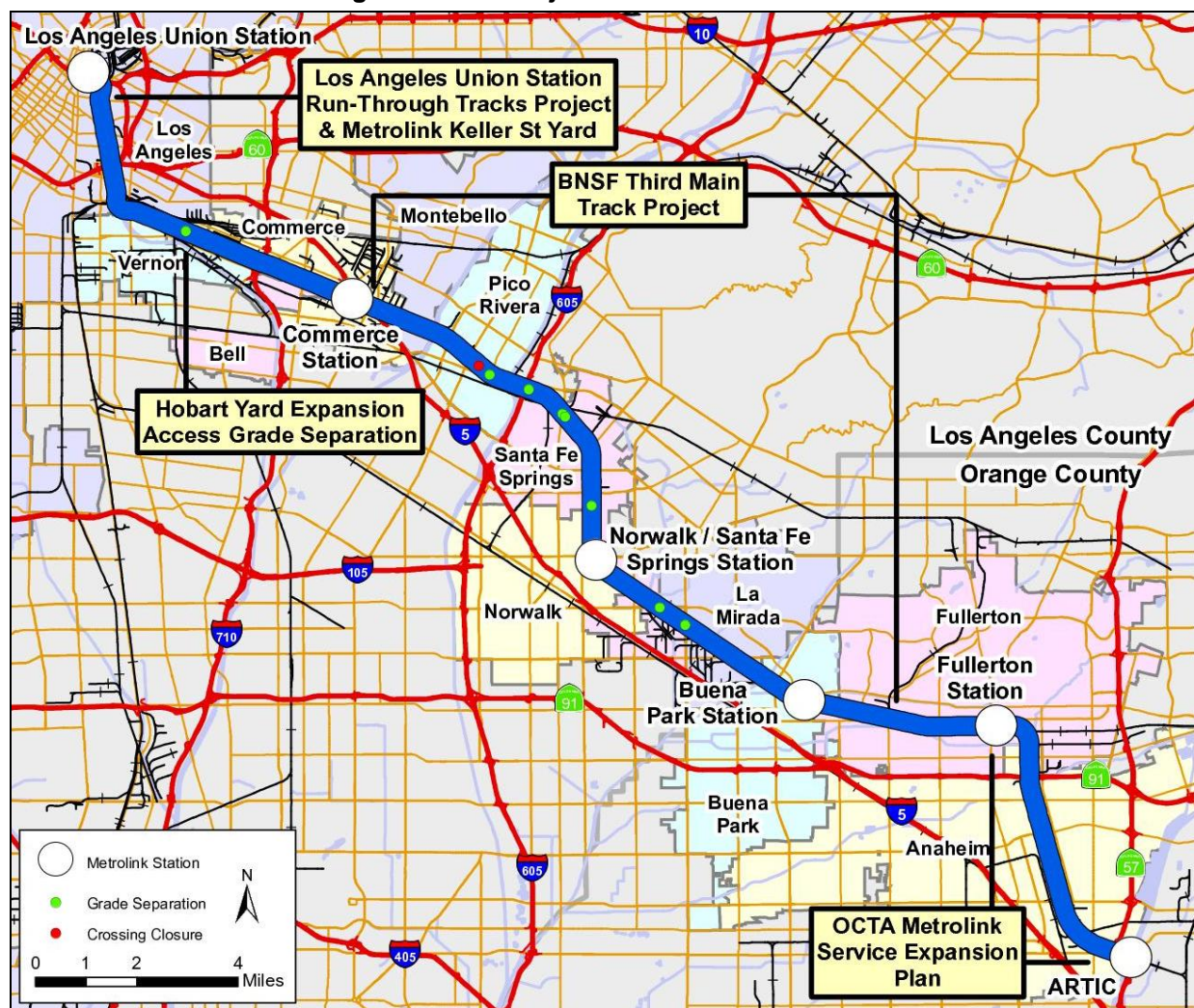
would be requested from the FRA in order that a “Shared-Track” alternative can be implemented in the corridor that allows for the coordinated operation of non-compliant high-speed trains with FRA-compliant Metrolink and Amtrak trains on the same tracks. This course of action may reduce requirements for capital infrastructure and associated impact and cost, but it would come with the requirement to closely coordinate and control operations among the different modes due to the heavy traffic on the corridor.

If such a waiver cannot be obtained for shared-track operations, regulatory approval would be sought for a HST alignment operating on tracks completely separate from the other operators in the LOSSAN corridor. By building tracks dedicated only to high-speed trains, there is no need to mix compliant and non-compliant trains. Until FRA compliance issues are resolved, FRA has required that a Dedicated HST Alternative be carried forward. This option was noted in the NEPA Notice of Intent and CEQA Notice of Preparation that were released in March 2007.

3.3 NO PROJECT ALTERNATIVE

The No Project Alternative represents corridor conditions today and in the future (2030) if the Anaheim to Los Angeles HST Project is not built. The alternative includes planned and funded projects for the area, as described in the SCAG 2008 Final Regional Transportation Plan (RTP). Major projects included in the No Project Alternative are shown in Figure 3.4 and described in the following sub-sections.

Figure 3.4. No Project Alternative – Overview

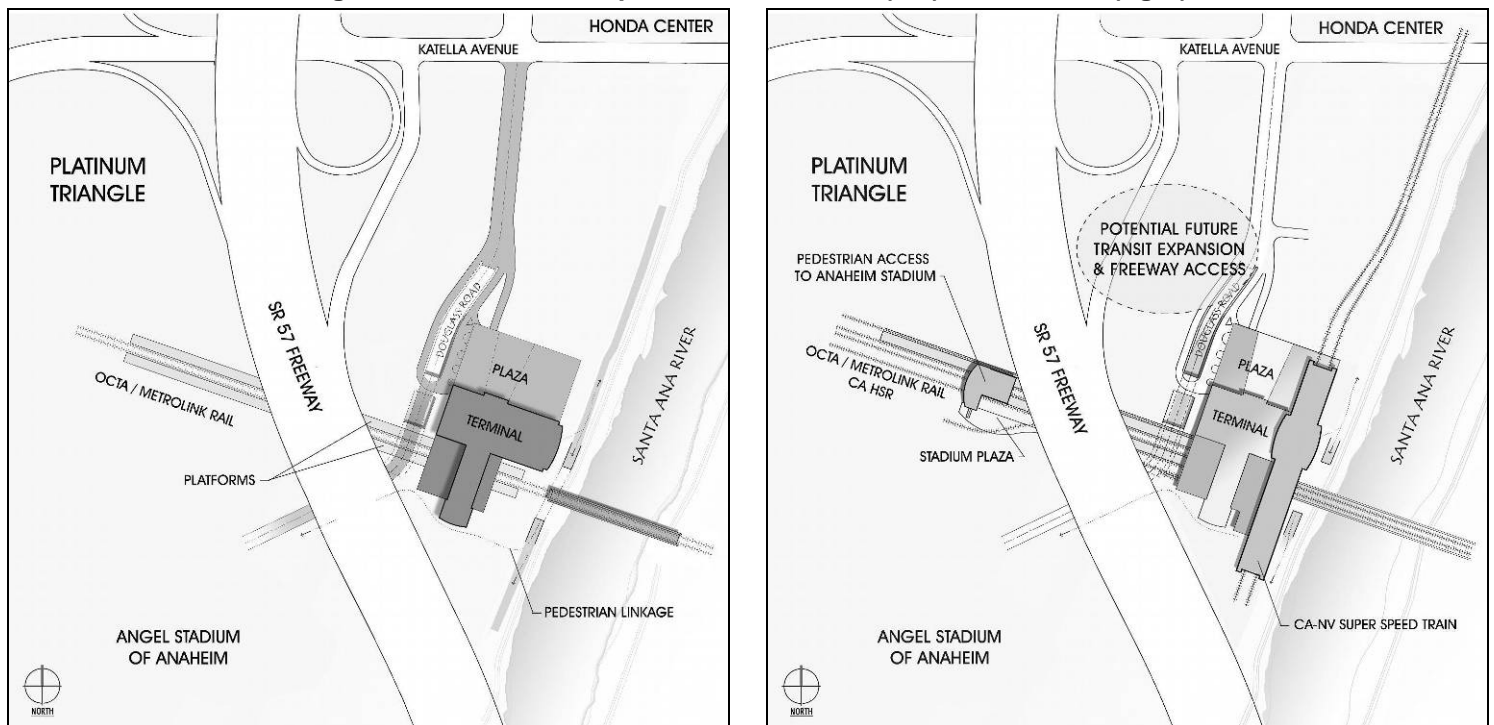


Source: AE LLC, STV Incorporated

3.3.1 Anaheim Regional Transportation Intermodal Center (ARTIC)

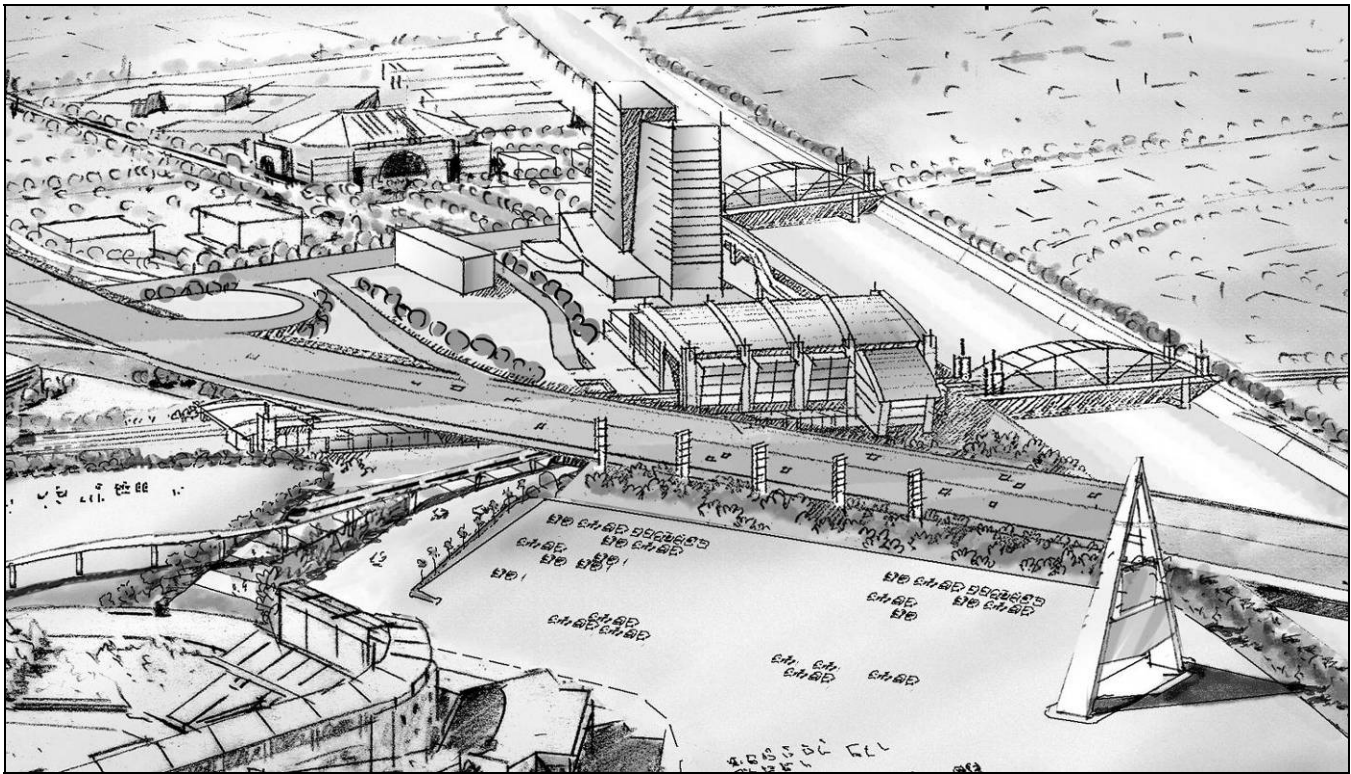
The ARTIC Project, to be developed as a collaborative effort between the Orange County Transportation Authority (OCTA) and the City of Anaheim, is a new multi-modal transportation center for the City of Anaheim. It is located where the LOSSAN corridor crosses under State Route 57 (the Orange Freeway), east of the existing Amtrak and Metrolink stations. ARTIC will be developed in two phases. Phase 1 will provide a new and relocated facility to serve Metrolink and Amtrak and connections for local rubber-tire transit services. Phase 1 will be completed in 2015 and is funded by local Measure T and Proposition 116 State Rail Bond funds. Phase 2 will provide additional passenger facilities and support services to accommodate a HST Station. Four more tracks, each with platforms for HST services will be provided at ARTIC under Phase 2. Construction of Phase 2 is not currently funded and will be considered part of the HST project alternatives. Phase 1 is considered as part of the No Project Alternative. Conceptual plans for the Phase 1 and 2 station footprints and design are shown in Figure 3.5, Figure 3.6 and Figure 3.7.

Figure 3.5. ARTIC Conceptual Plan – Phase 1 (left) and Phase 2 (right)



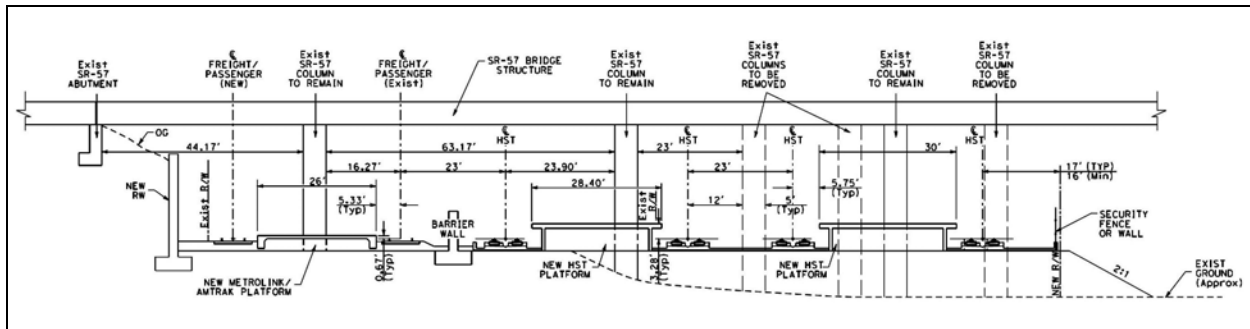
Source: OCTA, City of Anaheim, Carter & Burgess

Figure 3.6. ARTIC Phase 2 – Conceptual Rendering



Source: OCTA, City of Anaheim, Carter & Burgess

Figure 3.7. Proposed Cross-Section – Phase 2 ARTIC Station Platforms



Source: OCTA, City of Anaheim

3.3.2 OCTA 30-Minute Metrolink Service Expansion

The Orange County Transportation Authority (OCTA) is currently in the process of upgrading the existing LOSSAN corridor tracks and stations from Fullerton to Laguna Niguel to provide for expanded Metrolink service in Orange County. Upgrades will include new turnback and layover facilities at the northern and southern ends of the route, as well as improvements to tracks and stations throughout the county. The projected train operations after construction of this project include 146 daily trains. An overview map of the improvements is shown in Figure 3.8.

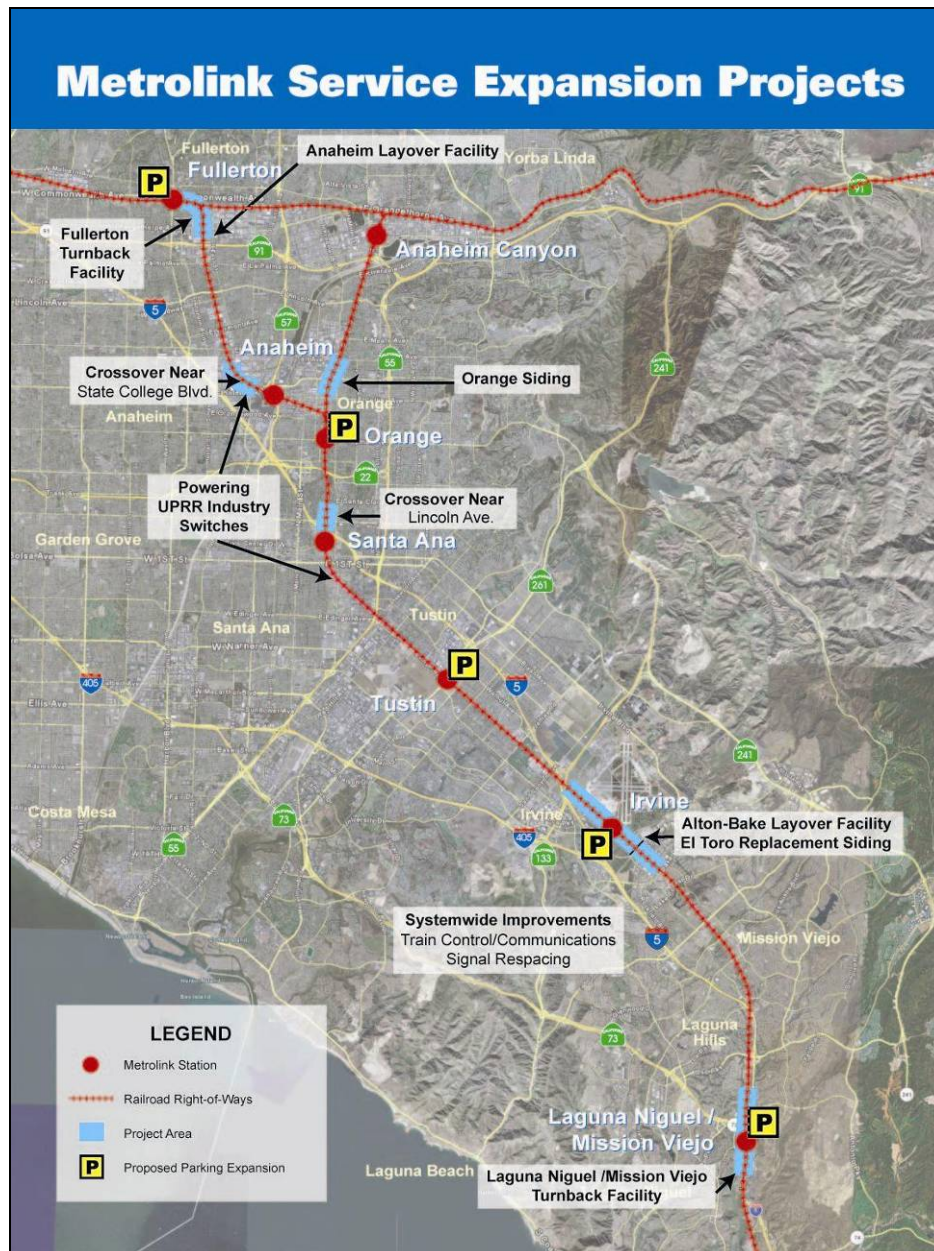
The three projects in the Expansion Program that will affect the A-LA section are:

- **CP Stadium Improvements** – Improvements are planned near the LOSSAN corridor crossings of State College Boulevard and Katella Avenue to provide better performance between Anaheim and

Fullerton. Improvements include a new powered switch to connect to the UP Tustin Branch, and new crossovers for the LOSSAN corridor tracks.

- **Anaheim Layover Facility** – The new locomotives and coaches that have been procured for the Service Expansion Plan will need to be stored and serviced during non-operating hours. A new layover facility is planned for northern Anaheim along the LOSSAN corridor between SR-91 and Orangethorpe Avenue to provide this layover capability. The facility includes two tracks and servicing areas to the west of the existing tracks in current plans.
- **Fullerton Turnback Facility** – New tracks and platforms are planned at the Fullerton Transportation Center to allow for OCTA trains to be turned back without joining the BNSF Mainline. The turnback facility will include a new track to the south of the existing south station platform, and modifications to the approaches from the south and station parking areas.

Figure 3.8. OCTA Metrolink Service Expansion Plan



Source: OCTA

3.3.3 BNSF Third Main Track and Grade Separation Project

The Burlington Northern Santa Fe (BNSF) Railway and California Department of Transportation (Caltrans) Division of Rail are currently designing and implementing a major improvement to the section of the LOSSAN corridor between Fullerton (Fullerton Junction) and Los Angeles (Redondo Junction). This section of the corridor, which carries BNSF interstate freight traffic heading to and from the ports of Los Angeles and Long Beach, BNSF's Hobart yard, and interchange traffic to the Los Angeles Junction Railway, as well as Amtrak and Metrolink passenger service, is nearing its capacity.

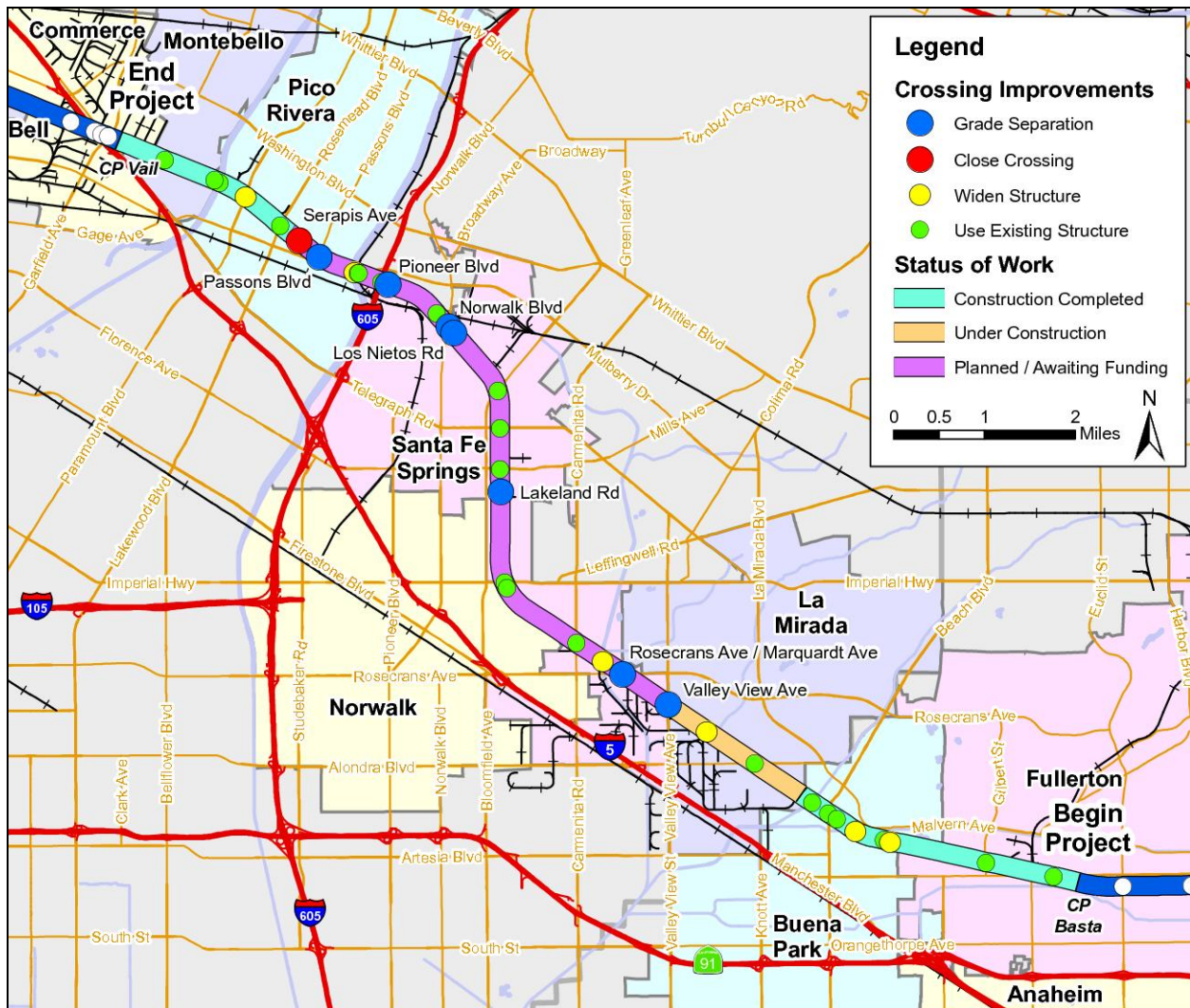
The Third Main Track Project will complete a third main track for the entire section from Fullerton to Los Angeles, as well as grade separating or closing the remaining eight at-grade road crossings in this stretch of the corridor. These improvements, which are described in the *Third Main Track and Grade Separation Project Draft* and *Final Environmental Impact Reports* (Caltrans, 2003), are intended to increase capacity, decrease congestion and delay, and enhance safety through the corridor.

The specific improvements planned for this project are shown in Figure 3.9, and listed below.

- **Third Main Track** from Control Point (CP) Basta (near Commonwealth Avenue crossing in Fullerton) to CP Vail (I-5 crossing in Commerce). A southern portion of the Third Main Track Project (from CP Basta to near Beach Boulevard in Buena Park) has already been completed as part of the new Buena Park Metrolink Station. To the north, the new track has been completed from CP Vail to near Serapis Avenue in Pico Rivera. The Third Main track is currently (as of Fall 2008) under construction between Beach Boulevard and Valley View Avenue in La Mirada, and a new bridge to carry the Third Main Track is being built over the San Gabriel River.
- **Crossing Closure** of current at-grade crossing at Serapis Avenue in Pico Rivera.
- **Grade Separations** (roadway underpasses) at the following current at-grade crossings:
 - Parsons Boulevard
 - Pioneer Boulevard
 - Norwalk Boulevard
 - Los Nietos Road
 - Lakeland Road
 - Rosecrans Avenue / Marquardt Avenue
 - Valley View Avenue

The Third Main Track Project is included in the SCAG 2008 RTP, and portions of it are moving forward as full funding is obtained. Grade separation projects at Parsons Boulevard and Valley View Avenue are currently partially or fully funded and nearing construction.

Figure 3.9. Planned Improvements – BNSF Third Main Track & Grade Separation Project

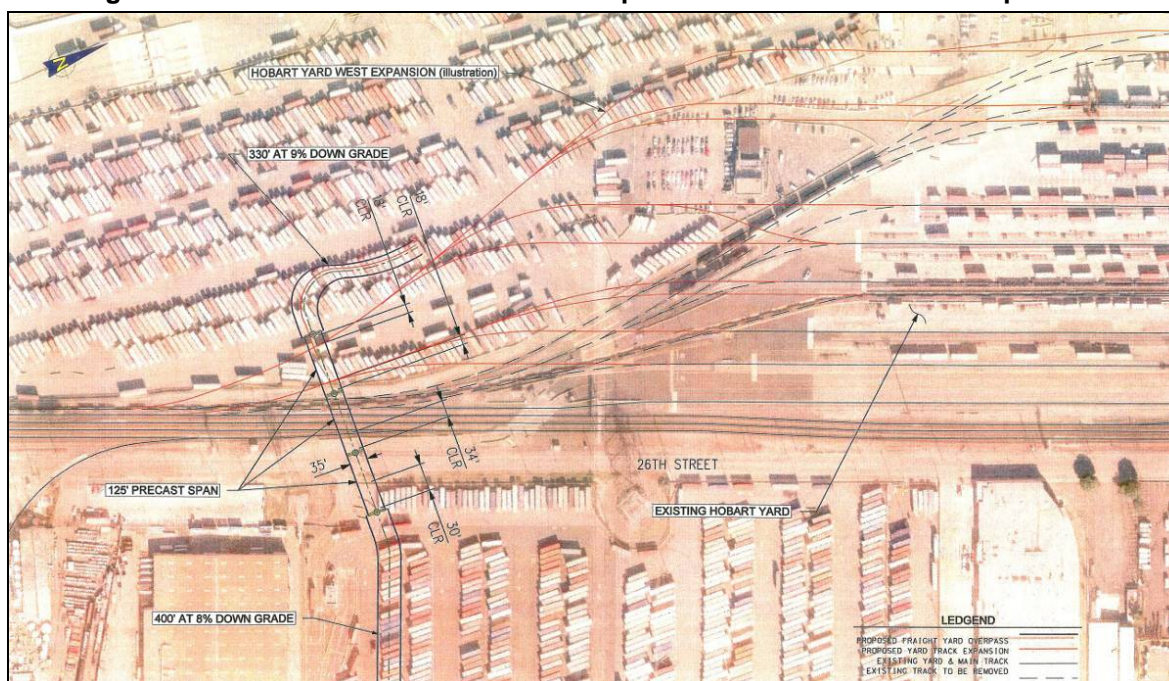


Source: AE LLC, Third Main Track EIR, STV Incorporated

3.3.4 BNSF Hobart Yard Expansion and Access Grade Separation

The BNSF Hobart Yard, located in the cities of Vernon and Commerce, handles much of the BNSF intermodal freight traffic in the LA Basin. A project on the western end of the yard will allow for the expansion west of several tracks as well as the grade separation of the main truck access point to Hobart Yard from the south. Preliminary plans for this project are shown in Figure 3.10, with its location on the corridor shown in Figure 3.4.

Figure 3.10. Planned BNSF Hobart Yard Expansion and Access Grade Separation



Source: BNSF, JL Patterson & Associates Inc

3.3.5 Metrolink Keller Street Yard

A small storage yard is planned by Metrolink for the area just east of Los Angeles Union Station between the existing LOSSAN corridor tracks and Keller Street. This will allow for emergency storage of trains in case of problems at LAUS. The planned yard is shown in Figure 3.11.

Figure 3.11. Proposed Metrolink Keller Street Yard – Overview



Source: Microsoft Virtual Earth, USGS, STV Incorporated

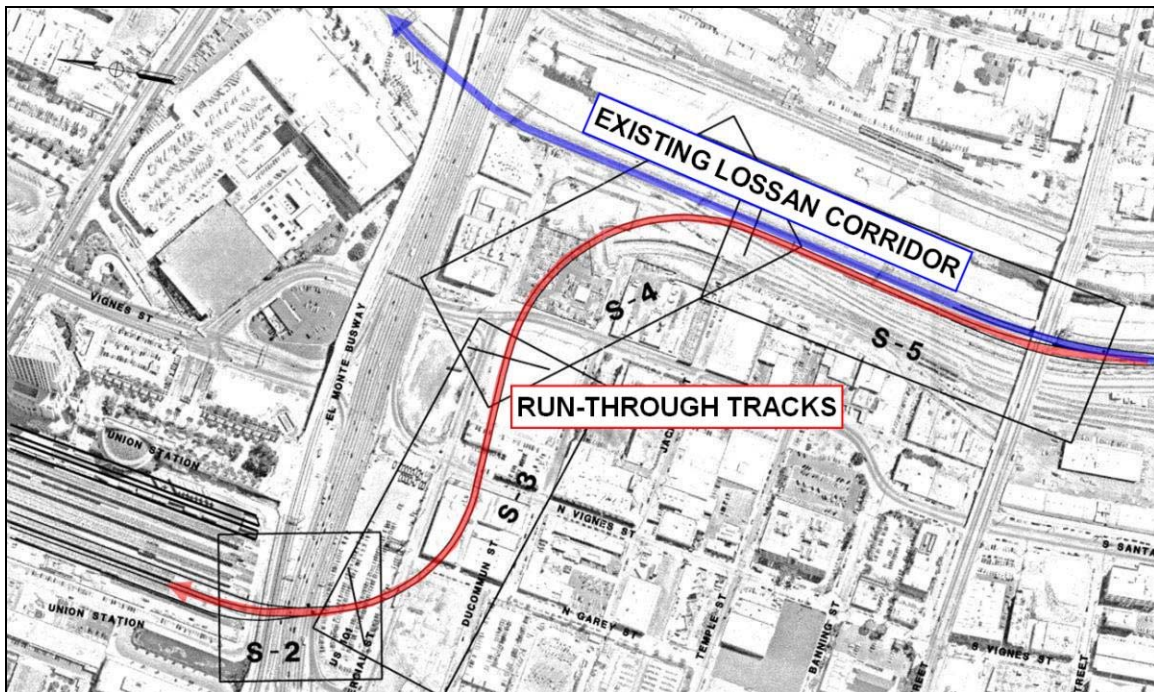
3.3.6 Projects to be Constructed / Operated by Others

There are several other proposed projects along the LOSSAN corridor that are not included as part of the No Project Alternative but are considered in operations or engineering plans so as not to preclude future consideration and construction. They are described below.

3.3.6.1 Los Angeles Union Station Run-Through Tracks Project

Amtrak and Caltrans have recently completed preliminary planning, environmental, and engineering studies for a new southern connection into Los Angeles Union Station (LAUS). This connection, referred to as the Los Angeles Union Station Run-Through Tracks Project, would introduce several benefits for LOSSAN corridor trains. One benefit over the current “stub-end” configuration is that trains are able to continue through the station without turning around, allowing through movements such as San Diego to San Luis Obispo for Amtrak Pacific Surfliner service or Orange County to Lancaster for Metrolink service. The tracks will also allow for a quicker trip into the station for trains coming from the south (which currently have to loop to the north to enter the station), and relieve capacity constraints at the north end of Union Station. An overview map for the Los Angeles Union Station Run-Through Tracks Project is shown in Figure 3.12.

Figure 3.12. Los Angeles Union Station Run-Through Tracks Project – Planned Configuration



Source: Amtrak, Caltrans, HDR, STV Incorporated

The EIR/EIS and substantial engineering effort for the LAUS Run-Through Tracks Project were completed by Caltrans and FRA and the project is waiting for full funding. There is no current timeline for the completion of design activities or the commencement of construction. Designs for the HST project in the LAUS area accommodate the run-through tracks so as not to preclude adding them at a later date.

3.3.6.2 LOSSAN Corridor Fourth Main Track – Fullerton to Redondo Junction

The Caltrans Department of Rail and FRA in cooperation with the Authority completed a study of how best to improve the LOSSAN corridor to support increased intercity rail service between Los Angeles and San Diego. A Strategic Plan for these improvements was published in October 2003, while a Draft Program EIR/EIS was published in July 2004. The improvements programmed for the LOSSAN corridor

Figure 3.13. LOSSAN Corridor Fourth Main Track – Fullerton to Redondo Junction – Overview



3.3.7 No Project Alternative Configuration by Subsection



FLYCALIFORNIA
Without ever leaving the ground

CALIFORNIA HIGH-SPEED RAIL AUTHORITY

3.3.7.1 Anaheim to Fullerton

Due to lower volumes of freight traffic, there are only two mainline LOSSAN corridor tracks through Anaheim. The LOSSAN corridor ROW is 100' wide in its northern and southern sections of the city, but may be constrained by utilities. A key subsection between Vermont Avenue and North Street is only 50' wide.

A typical cross-section for the 100' ROW is shown in Figure 3.14, and a typical cross-section for the 50' ROW is shown in Figure 3.15.

Planned projects along the LOSSAN corridor through Anaheim include:

- **Anaheim Regional Transportation Intermodal Center** (See Section 3.3.1)
- **OCTA Metrolink Service Enhancements** (See Section 3.3.2), including:
 - CP Stadium Improvements
 - Anaheim Layover Facility
 - Fullerton Turnback Facility

Figure 3.14. Typical Cross-Section – No Project Alternative – Anaheim 100' ROW

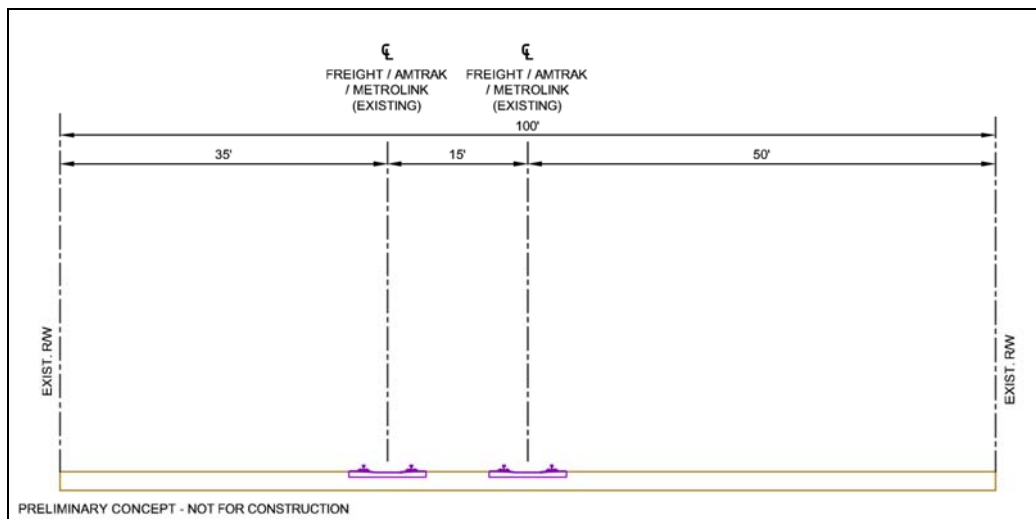
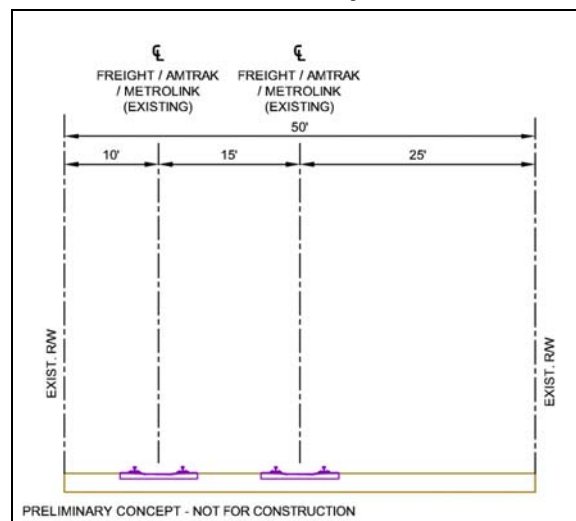


Figure 3.15. Typical Cross-Section – No Project Alternative – Anaheim 50' ROW



Source: STV Incorporated

3.3.7.2 Fullerton to Hobart Yard

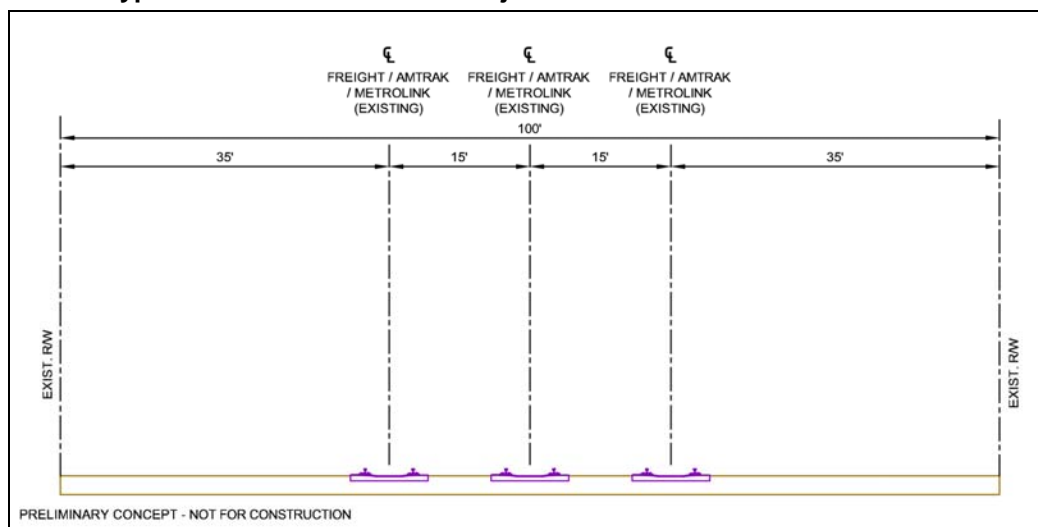
The passenger-oriented OCTA Orange Subdivision meets the freight-oriented BNSF San Bernardino Subdivision just to the east of the Fullerton Transportation Center at Fullerton Junction. The junction represents the southern end of the subsection from Fullerton to Hobart Yard that carries large volumes of both passenger and freight traffic.

The subsection of the LOSSAN corridor between Fullerton and Hobart Yard runs through a number of cities, including:

- Fullerton
- Buena Park
- La Mirada
- Santa Fe Springs
- Norwalk
- South Whittier / Los Nietos (Unincorporated Los Angeles County)
- Pico Rivera
- Montebello
- Commerce
- Bell
- Vernon

Through these areas, the LOSSAN corridor is upgraded to three mainline tracks as part of the BNSF Third Main Track project. In addition, the remaining at-grade road crossings are grade separated or closed. A typical cross-section for the Fullerton to Hobart Yard subsection of the project is shown in Figure 3.16.

Figure 3.16. Typical Cross-Section – No Project Alternative – Fullerton to Hobart Subsection



Source: STV Incorporated

Planned projects along the LOSSAN corridor between Fullerton and Hobart Yard include:

- **OCTA Metrolink Service Enhancements** (See Section 3.3.2) (Fullerton), including:
 - Fullerton Turnback Facility

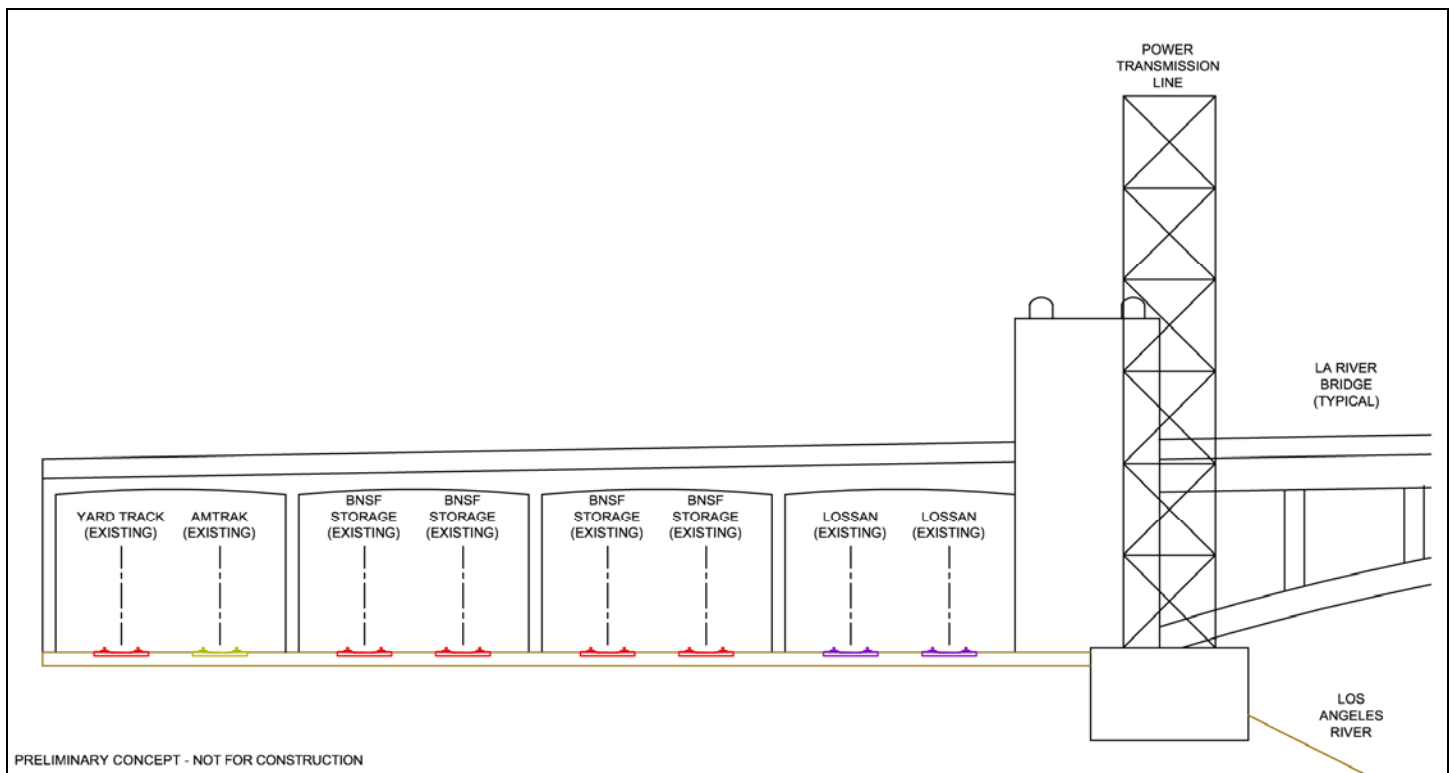
- **BNSF Third Main Track Project** (See Section 3.3.3) (Buena Park – Montebello), including Crossing Closure at Serapis Ave (Pico Rivera) and grade separations (underpasses) at:
 - Valley View Avenue (La Mirada / Santa Fe Springs)
 - Rosecrans Avenue / Marquardt Avenue (Santa Fe Springs)
 - Lakeland Road (Santa Fe Springs)
 - Los Nietos Road (Santa Fe Springs)
 - Norwalk Boulevard (Santa Fe Springs)
 - Pioneer Boulevard (Santa Fe Springs / LA County)
 - Parsons Boulevard (Pico Rivera)
- **BNSF Hobart Yard Expansion and Access Grade Separation** (See Section 3.3.4) (Vernon)

3.3.7.3 Hobart Yard to LAUS

In the City of Los Angeles at Redondo Junction, the LOSSAN corridor splits from BNSF intermodal freight heading to the ports of Los Angeles and Long Beach and heads north along the west bank of the Los Angeles River. A typical cross-section for the LOSSAN corridor along the Los Angeles River is shown in Figure 3.17.

In Los Angeles, there is one planned project to improve the LOSSAN corridor in the vicinity of Los Angeles Union Station: the Metrolink Keller Street Yard (See Section 3.3.5)

Figure 3.17. Typical Cross-Section – No Project Alternative – Los Angeles River



Source: STV Incorporated

The Shared-Track Alternative selected during the Program-Level Environmental Analysis for the Anaheim-LA section is considered in this preliminary analysis of alternatives with modifications to its configuration. Most of the changes result from greater level of detail presented in the project-level environmental analysis or to changes in the baseline conditions in the corridor since the Program EIR/EIS was completed. Generally, they include design modifications to the typical at-grade configuration in station areas and where freight access is needed to south side of the right-of-way, as discussed in detail in Section 4.0. From the junction with the San Diego to Los Angeles section of the HST system at Hobart Yard north to Union Station, high-speed trains will run on a dedicated alignment.

The Project EIR/EIS addresses the HST system between Anaheim and Los Angeles. The section between Irvine and Anaheim through Central Orange County will be studied as part of a future, separate Project EIR/EIS. The route and general configuration for the Program-Level Shared-Track Alternative are shown in Figure 3.18. HST stations are currently planned at Anaheim and Los Angeles Union Station, with an intermediate station either at Norwalk / Santa Fe Springs or Fullerton.

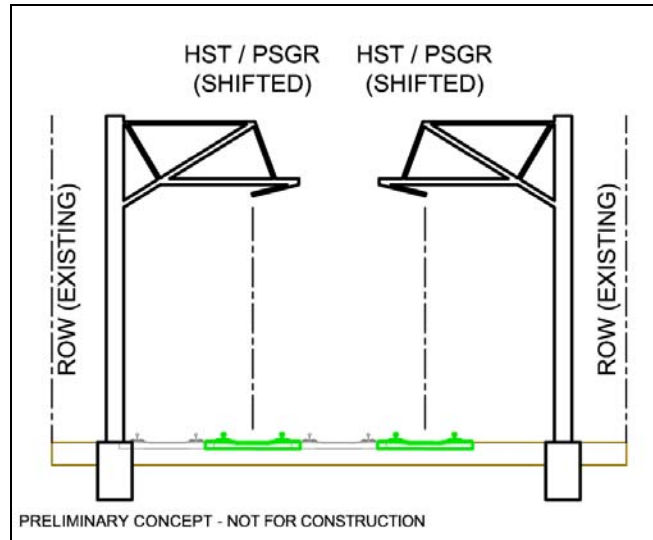
Figure 3.18. Program-Level Shared-Track Alternative – Overview



3.4.1 Typical Configuration – Anaheim to Fullerton

The Program-Level Shared-Track Alternative assumes that the existing two LOSSAN corridor tracks through the City of Anaheim are upgraded and used for shared HST / Amtrak / Metrolink service (freight service will take place during windows when high-speed trains are not running). The tracks are currently not centered in the ROW, and given the need for additional width to accommodate OCS poles it is likely that a minor track shift is needed. A typical cross-section for this alternative is shown in Figure 3.19.

Figure 3.19. Typical Cross-Section – Anaheim – At-Grade Shared Option



Source: STV Incorporated

Given the high operating speeds of high-speed trains along the LOSSAN corridor, all highway crossings will need to be grade separated to ensure maximum safety for rail passengers and auto drivers. Current plans are for seven crossings in Anaheim to be grade separated and three to be closed. These crossings, along with the other at-grade crossings in Anaheim, are shown in Figure 3.20 and Table 3.1.

Figure 3.20. Proposed Improvements at Anaheim At-Grade Crossings – Shared-Track Alternative



Table 3.1. Proposed Improvements at Anaheim At-Grade Crossings – Shared-Track Alternative

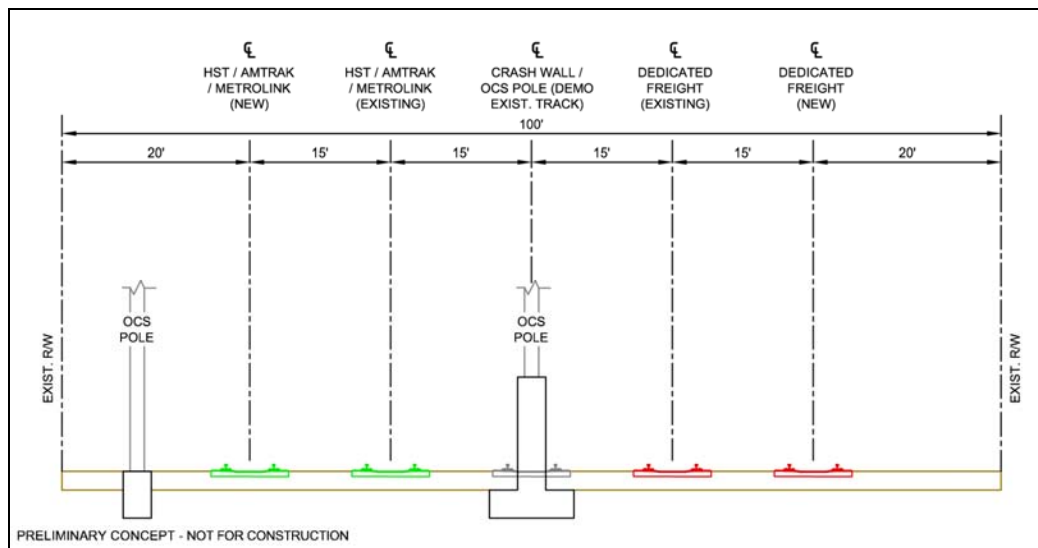
#	Crossing Name	Crossing Facility	Current Configuration	Proposed Improvement
49	Douglass Road	Minor Street	Under	ARTIC Station
50	State Route 57 (Orange Freeway)	Freeway	Over	ARTIC Station
51	Anaheim Amtrak / Metrolink Station – Pedestrian Tunnel	Pedestrian	Under	ARTIC Station
52	Katella Avenue	Arterial	Under	None
53	State College Boulevard	Arterial	At-Grade	Grade Separation
54	Union Pacific Tustin Branch	Railroad	At-Grade	Close Crossing
55	Cerritos Avenue	Minor St	At-Grade	Grade Separation
56	Lewis Street	Minor St	Under	None
57	Ball Road	Arterial	At-Grade	Grade Separation
58	Vermont Avenue	Arterial	At-Grade	Grade Separation
59	South Street	Minor Street	At-Grade	Close Crossing

#	Crossing Name	Crossing Facility	Current Configuration	Proposed Improvement
60	Santa Ana Street	Minor St	At-Grade	Close Crossing
61	Broadway	Arterial	At-Grade	Grade Separation
62	Lincoln Avenue	Arterial	Under	None
63	Sycamore Street	Minor St	At-Grade	Close Crossing
64	La Palma Avenue	Arterial	At-Grade	Grade Separation
65	Carbon Creek	River	Under	None
66	State Route 91 (Riverside Freeway)	Freeway	Over	None
67	Orangethorpe Avenue	Arterial	At-Grade	Grade Separation

3.4.2 Typical Configuration – Fullerton to Hobart Yard

The most complicated and congested subsection of the A-LA project is between Fullerton Junction and Hobart Yard, where large volumes of BNSF freight traffic Metrolink, Amtrak, and HST passenger trains would operate. The Program-Level Shared-Track Alternative would require two tracks for freight trains and two for shared passenger operations in this section. The Program-Level Shared-Track Alternative can typically be accommodated at-grade without significant ROW takes. To do so, two new tracks would be built to the outside of the existing three main tracks, and the center track would be removed and replaced with a crash barrier as needed to segregate freight trains from passenger trains. A typical cross-section view of this configuration is shown in Figure 3.21.

Figure 3.21. Typical Cross-Section – Fullerton to Hobart – Program-Level Shared-Track Alternative



Note: Crash wall is not mandatory and is subject to further analysis.
Source: STV Incorporated

3.4.3 Typical Configuration – Hobart Yard to LAUS

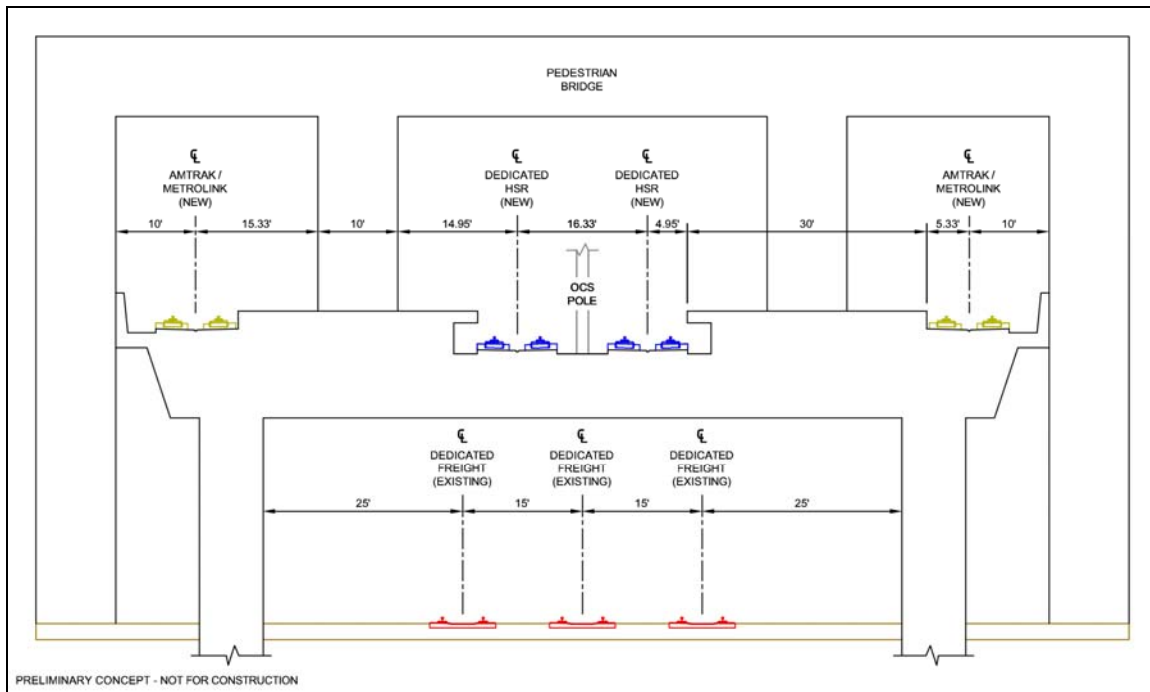
The typical configuration for the Program-Level Shared-Track Alternative from Hobart Yard to LAUS is identical to the other two project alternatives, and is described in Sections 4.12 and 4.13.

3.4.4 Typical Configuration – Stations

Stations for the Program-Level Shared-Track Alternative require additional tracks and 1,380 foot-long platforms to accommodate the different vehicle technologies and designs used for the HST, Metrolink, and Amtrak trains that will share the passenger tracks. In general, four tracks and two platforms are needed at all stations along the route (including existing Metrolink stations at which high-speed trains will not be stopping). This requires either substantial ROW takes or aerial structures to be able to fit at least

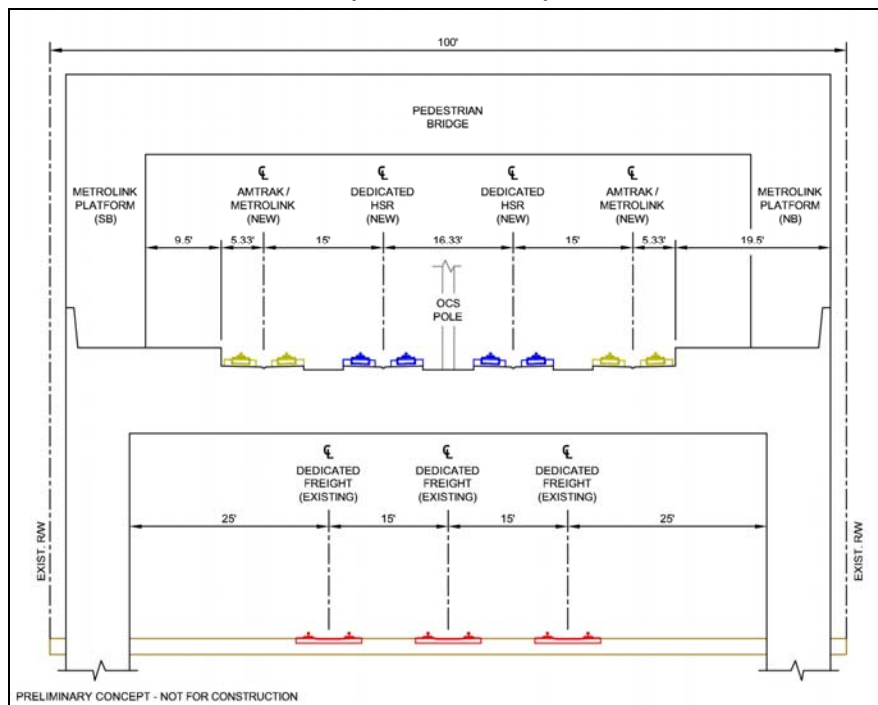
six tracks through station areas. Typical aerial station designs for stations with and without high-speed trains stopping are shown in Figure 3.22 and Figure 3.23.

Figure 3.22. Typical Station Design – Program-Level Shared-Track Alternative with HST Stopping (Island Platforms)



Source: STV Incorporated

Figure 3.23. Typical Station Design – Program-Level Shared-Track Alternative with HST Bypass (Side Platforms)



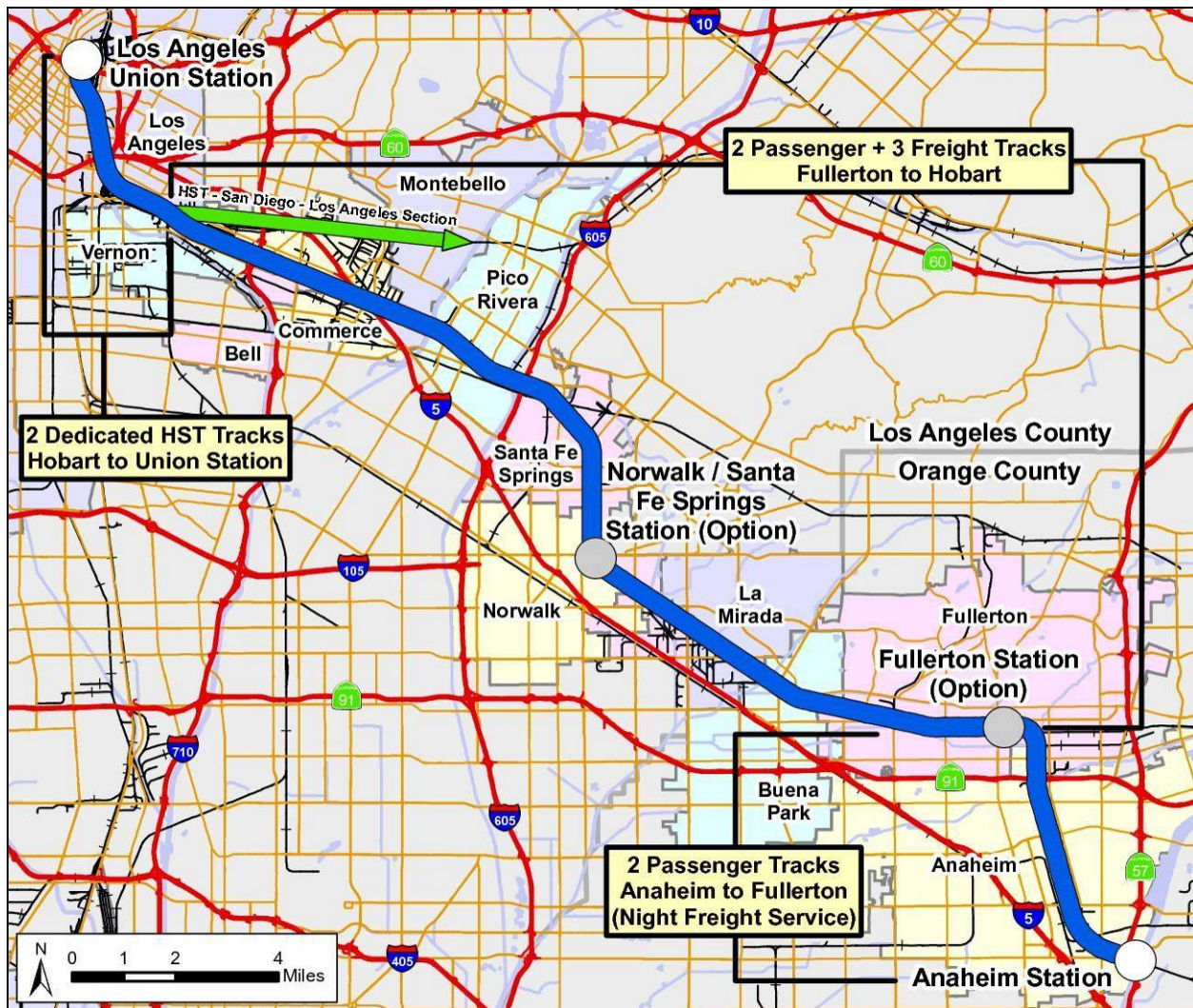
Source: STV Incorporated

3.5 EXPANDED SHARED-TRACK ALTERNATIVE (3+2)

The results from the Operational Feasibility Study (discussed in Section 3.7) indicate that the two tracks dedicated to BNSF freight traffic as part of the Program-Level Shared-Track Alternative between Fullerton and Los Angeles will not be able to accommodate the future freight traffic in the corridor. As a result, an expanded shared-track alternative featuring three tracks for freight trains (instead of two) for the subsection between Fullerton and Hobart Yard has been defined. Given the current width of the ROW in this corridor, this will necessitate additional ROW, a shift of the existing track alignments, and/or additional aerial structures (as discussed in the following sub-section). The configuration of this “Expanded Shared-Track Alternative” would be the same as the Program-Level Shared-Track Alternative for the sections from Anaheim to Fullerton and Hobart Yard to Los Angeles Union Station. An overview of the alternative is shown in Figure 3.24.

Baseline Alignment Drawings for the Expanded Shared-Track Alternative can be found in Appendix D.

Figure 3.24. Expanded Shared-Track Alternative – Overview



Source: AE LLC, STV Incorporated

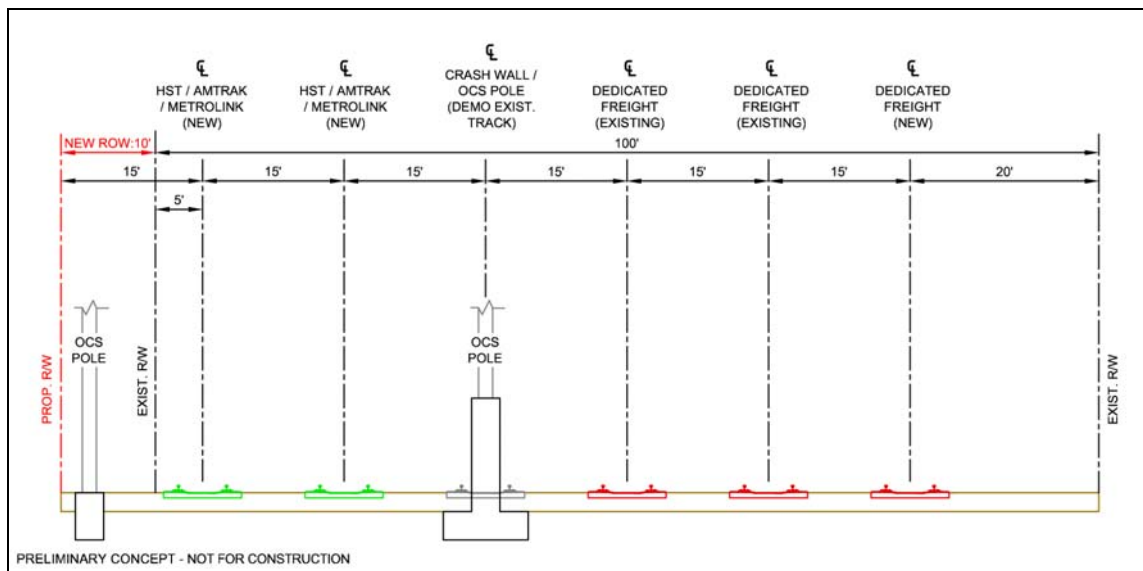
3.5.1 Typical Configuration – Anaheim to Fullerton

The typical configuration for the Expanded Shared-Track Alternative through Anaheim is identical to that of the Program-Level Shared-Track Alternative, and is described in Section 3.4.1.

3.5.2 Typical Configuration – Fullerton to Hobart Yard

From Fullerton to Hobart Yard, five tracks would be needed for the Expanded Shared-Track Alternative. Generally, two new tracks would be added to the south of the existing tracks and one to the north. This would allow use of two existing tracks and many of the existing grade crossing structures. The existing south track would be relocated and replaced with a crash barrier. Such a configuration typically would require approximately 10' of additional ROW on the south side of the corridor as shown in Figure 3.25. In limited circumstances, less ROW may be taken with the application of minimum clearances on the south side of the ROW and special accommodations for catenary poles and wayside equipment.

Figure 3.25. Typical Cross-Section – Fullerton to Hobart Yard – Expanded Shared-Track Alternative



Source: STV Incorporated

3.5.3 Typical Configuration – Hobart Yard to LAUS

The typical configuration for the Expanded Shared-Track Alternative from Hobart Yard to LAUS is identical to the other two project alternatives, and is described in Sections 4.12 and 4.13.

3.5.4 Typical Configuration – Stations

Stations for the Expanded Shared-Track Alternative are nearly identical to those of the Program-Level Shared-Track Alternative, but require one additional freight track. They also would require either substantial ROW takes or aerial structures to be able to fit at least seven tracks through station areas. The seven tracks are for two station platform tracks for stopping Amtrak and Metrolink trains, two bypass tracks for through Amtrak, Metrolink and High-Speed trains, and three freight tracks. Typical aerial station designs for stations with and without high-speed trains stopping are shown in Figure 3.22 and Figure 3.23.

3.6 DEDICATED HIGH-SPEED TRAIN ALTERNATIVE (4+2)

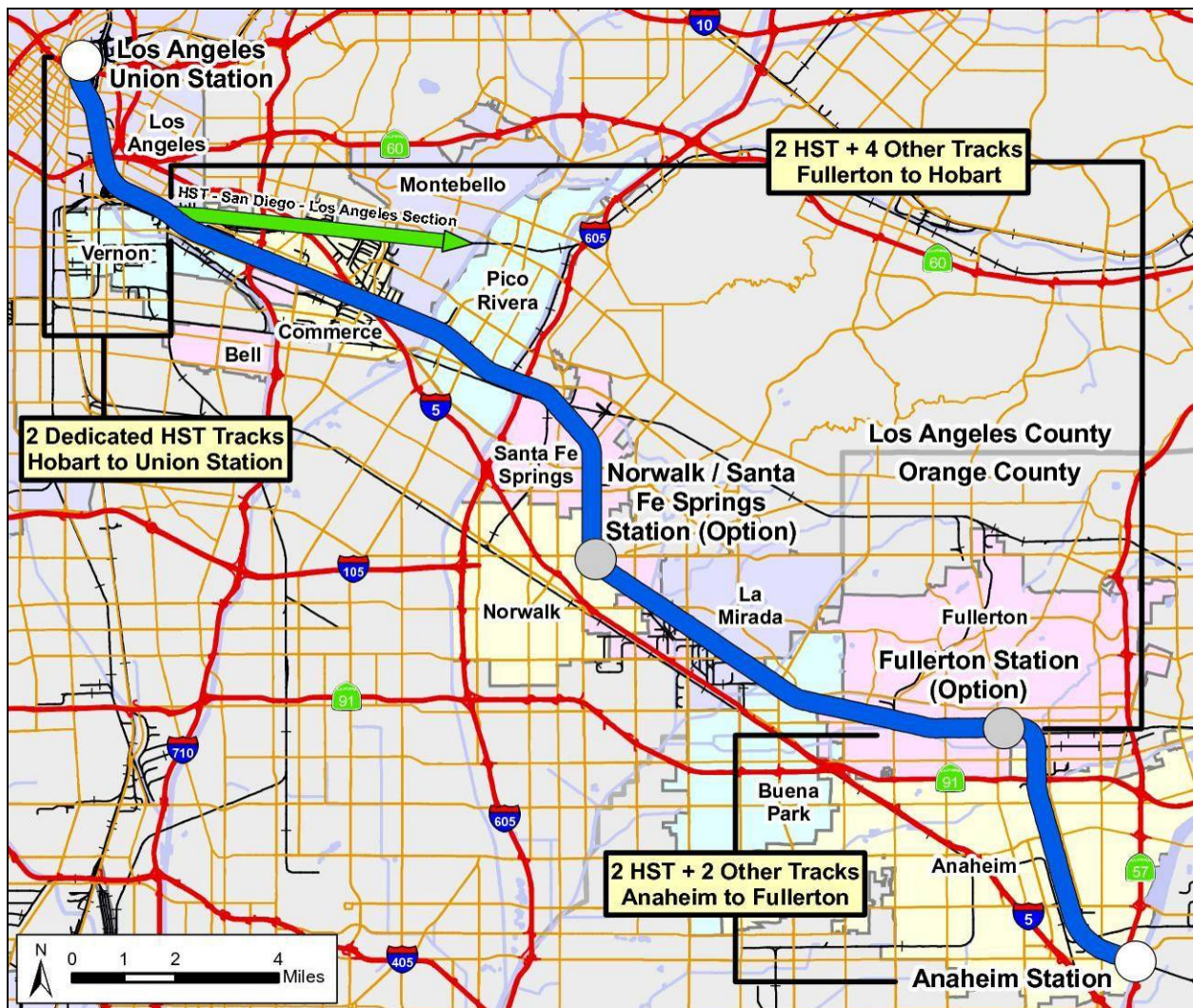
In the “Dedicated HST” Alternative (4+2), high speed trains would run on two dedicated tracks and leave enough ROW for all non-HST traffic to operate on up to four conventional tracks should they be required in the future. The Dedicated HST Alternative is described in the following sections.

The Dedicated HST configuration would allow for at least 6 main tracks total in the Fullerton to Hobart section of the corridor (2 HSR Tracks + 4 Other Tracks) plus 4 main tracks from Fullerton to Anaheim (2 HSR Tracks + 2 Other Tracks). It would be possible to configure the Dedicated HST Alternative to ensure separation of FRA-Compliant and Non-Compliant trains. Given the current widths of the ROW in these sub-sections, this configuration would likely involve substantial ROW takes, and/or aerial structures.

These ROW takes, however, can be lessened by shifting the existing tracks and using minimum design standards for horizontal clearances. An aerial structure to carry high-speed trains could be fit into the corridor with little additional ROW. An overview of the alternative is shown in Figure 3.26.

Alignment Drawings for the Dedicated HST Alternative can be found in Appendix E.

Figure 3.26. Dedicated HST Alternative – Overview



Source: AE LLC, STV Incorporated

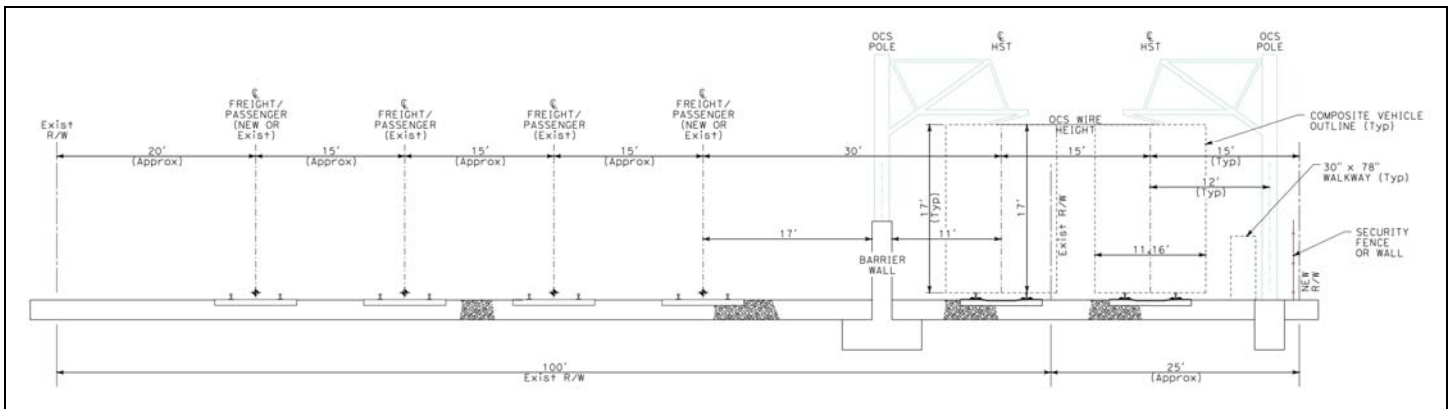
3.6.1 Typical Configuration – Anaheim to Fullerton

The typical configuration for the Dedicated HST Alternative through Anaheim requires two additional tracks. Options for this alternative through Anaheim are described in Section 4.3.

3.6.2 Typical Configuration – Fullerton to Hobart Yard

From Fullerton to Hobart Yard, space for six tracks would typically be needed for the Dedicated HST Alternative. Similar to the Expanded Shared-Track Alternative, two new tracks would be added to the south of the existing tracks (space is provided for a future fourth track to the north). This allows the reuse of the three existing tracks and many of the existing grade crossing structures. However, such a configuration would require approximately 25' of additional ROW on the south side of the corridor as shown in Figure 3.27 and on Sheet 7B in Appendix E. It may be possible to acquire less ROW with minimum clearances and special accommodations for catenary poles and wayside signal equipment. In constrained areas, shifted at-grade or aerial alignment options are investigated to minimize ROW takes. Trench and tunnel options are generally not feasible in this section due to the extensive number of existing undercrossings in the corridor and the required depth of tunnel, except for short tunnels or trenches required by special geographic or ROW constraints.

Figure 3.27. Typical Cross-Section – Fullerton to Hobart Yard – Dedicated HST Alternative



Source: STV Incorporated

3.6.3 Typical Configuration – Hobart Yard to LAUS

The typical configuration for the Dedicated HST Alternative from Hobart to LAUS is identical to that of the Shared-Track Alternatives, and is described in Sections 4.12 and 4.13.

3.6.4 Typical Configuration – Stations

Stations for the Dedicated HST Alternative differ from those of the Shared-Track Alternatives in that they do not need to serve Metrolink and Amtrak passengers. This eliminates the requirements that the HST line have station facilities at Metrolink / Amtrak only station stops (Buena Park, Commerce, and possibly Fullerton and/or Norwalk / Santa Fe Springs if HST stations are not built), and simplifies the design of any intermediate stations where HST may stop (Fullerton or Norwalk / Santa Fe Springs).

3.7 OPERATIONAL FEASIBILITY STUDY

Future 2030 operations of the HST passenger service, existing Metrolink and Amtrak passenger service and BNSF freight operations were modeled for each of the project alternatives. For the high speed trains, the timetable used for this analysis was based on three trains per hour at an average of 20 minute headways. This original timetable was based on the preliminary "high level" ridership demand forecast developed by Cambridge Systematics that identified a demand of 26 HST per day between Los Angeles

and Anaheim. For the purposes of modeling, the number of trains per hour was developed based on how many trains could feasibly operate under various service configurations assumed for the conventional rail services. A maximum number of 3 trains per hour was then developed after several iterations of the model determined the most feasible times and frequencies HS trains could be operated using the infrastructure and conventional rail service assumptions under each alternative.

The modeling involved a simulation of current and future operations for freight and passenger rail operators along the LOSSAN corridor between Anaheim and Los Angeles using railroad operations modeling software. A Concept Level Operational Feasibility Study for the Anaheim to Los Angeles Section was completed in July 2008, and is included in Appendix B of this report.

The modeling of HST passenger service between Anaheim and Los Angeles was tested and evaluated to prove the service reliable and not subject to delays that may be incurred by the operations of the existing freight and passenger rail operators. These initial evaluations were then examined in the context of the operational dynamics resident in the Phase 1 Service Plan (developed in December 2008, and included in Appendix F) to determine whether the alternatives could accommodate the refined service patterns in the Phase 1 Service Plan under the proposed timetable for the HST service. The Phase 1 Service Plan was developed based on a much more detailed ridership demand forecast that was produced by Cambridge Systematics, specific to the Phase 1 service scenario, and subsequent to the “high level” of train operation forecasts used for the July 2008 Operations Analysis. . Using the ridership estimates developed to formulate the stopping patterns and equipment requirements, the Phase 1 Service Plan identified the need for up to five trains per hour between Anaheim and Los Angeles.

3.7.1 No Project Alternative

The modeling of the future No Project Alternative was done to determine, at a conceptual level of analysis, the feasibility of a three mainline track configuration providing sufficient capacity to operate the forecast levels for BNSF freight, Amtrak and Metrolink trains.

The results of the simulation modeling and analysis indicated that three mainline tracks did not provide sufficient capacity for the forecast level of freight and passenger trains without the HST Project. Based upon analysis of the Model outputs including stringline graphs of the simulated trains, it was determined that:

- Three main tracks are not adequate to support the assumed volume of freight trains plus forecast Amtrak and Metrolink service at an acceptable level of performance/delay using existing performance characteristics as the baseline.
- Four interconnected main tracks would provide sufficient capacity to feasibly support the assumed volume of freight trains plus forecast Metrolink and Amtrak service at an acceptable level of performance/delay using existing performance as the baseline.

3.7.2 Program Level Shared Track Alternative

For the Program-Level Shared-Track Alternative, four mainline tracks were modeled between Redondo Junction and Fullerton Junction with two interconnected tracks designated exclusively for BNSF freight trains and two interconnected tracks designated exclusively for “shared use” among passenger trains (HST, Metrolink and Amtrak). This modeling assumed a “complete” physical separation between the two interconnected freight tracks and the two interconnected passenger tracks in the Model, essentially defining two discrete, “two track systems”. Between Fullerton and Anaheim two main tracks were assumed, with freight operations time separated to overnight hours.

While the results of the simulation modeling and analysis indicated that two mainline tracks could feasibly support, at a maximum, the combined forecast levels of Amtrak, Metrolink and the (one) HST as tested in the model, it assumed that Metrolink passenger trains would have performance characteristics similar to those of the HST and that this infrastructure configuration would only be able to support an average of one HST per hour in each direction. Using the ridership estimates developed to formulate the stopping

patterns and equipment requirements, the Phase 1 Service Plan identified the need for up to five trains per hour between Anaheim and Los Angeles. Based on this service requirement, it was determined that this alternative does not adequately support the assumed volume of freight or passenger trains at an acceptable level of performance/delay using the performance requirements.

3.7.3 Expanded Shared Track Alternative

Five mainline tracks were modeled between Redondo Junction and Fullerton Junction for the Expanded Shared-Track Alternative under the following two scenarios.

3.7.3.1 Exclusive Freight / Passenger Tracks

The first scenario modeled three interconnected tracks designated exclusively for BNSF freight trains and two interconnected tracks designated exclusively for the “shared use” of passenger trains; HST, Amtrak (Pacific Surfliner and Southwest Chief trains), and Metrolink, which includes 91 Line / Perris Valley Line (PVL) and Orange County Line trains. As in the Program Level Shared Track Alternative a “complete” physical separation between the three interconnected freight tracks and the two interconnected passenger tracks was assumed in the Model, essentially defining two discrete rail systems: one “three track system” and one “two track system”. Between Fullerton and Anaheim two main tracks were assumed, with freight operations time separated to overnight hours.

While the results of the simulation modeling and analysis indicated that, as with the Program Level Shared Track Alternative, two mainline tracks could feasibly support Amtrak, Metrolink and (one) HST, this analysis again assumed that Metrolink passenger trains would have performance characteristics similar to those of the HST and that HST Service under this configuration would only be able to support an average of one HST per hour in each direction. Given that the Phase 1 Service Plan identifies the need to operate up to 5 HST per hour, it was determined that this alternative does not adequately support the forecast volume of passenger trains at an acceptable level of performance/delay using the performance requirements.

3.7.3.2 Shared Freight & Passenger + Shared HST & Passenger Tracks

The second scenario modeled attempted to accommodate additional HST service through the corridor by operating Amtrak and Metrolink 91 Line trains to the three freight tracks. This scenario modeled three interconnected tracks shared among BNSF freight trains, Amtrak Pacific Surfliner and Southwest Chief trains and Metrolink 91 Line / PVL trains and two interconnected tracks designated exclusively for HST and Metrolink Orange County Line trains. The concept of physically separating two tracks from the three interconnected tracks used for the combined operation of freight, Amtrak and Metrolink PVL trains was assumed in the model, essentially defining two discrete rail systems; one “three track system” and one “two track system”. Between Fullerton and Anaheim two main tracks were assumed, with freight operations time separated to overnight hours.

The initial results of the simulation modeling and analysis indicated that two interconnected mainline tracks are capable of supporting the forecast levels of Metrolink Orange County Line and “30 Minute” Service and up to 3 HST per hour in each direction. It was determined that three main freight/conventional passenger tracks could feasibly support the assumed volume of freight trains plus forecast Metrolink PVL and Amtrak trains at an acceptable level of performance/delay using existing performance as the baseline. In addition, it was determined that there is a potential need for a third track between Fullerton and Anaheim which should be examined should this concept be carried forward for further study.

Since the preferred Service Plan for Phase 1 and the Full Build-Out were not developed when this analysis was originally performed, a subsequent review was conducted that overlaid the Phase 1 Service Plan with the forecast volumes for freight and conventional rail services to determine the continued feasibility of shared use operations along the HST corridor under the new Service Plan. For this review, numerous capacity constraints were identified between Fullerton and Redondo Junctions and between

Fullerton Junction and Anaheim. Under this assumption the stopping patterns identified for the Metrolink Orange County Line, “30 minute” service, and the HST service do not provide for sufficient headway to accommodate the reliable operation of the 5 high speed trains per hour as required by the Phase 1 Service Plan.

For example, the amount of time it takes a single Metrolink train to travel between Los Angeles and Anaheim is the equivalent of 9 HST time “slots”, assuming the 3 minute headways provided by the HST signal system. The capacity of this corridor is then further constrained in the segment between Fullerton and Anaheim where the schedule would need to accommodate all of the Amtrak Pacific Surfliner trains operating between Los Angeles and San Diego.

It should also be noted that under this shared use configuration, Pacific Surfliner and Metrolink trains operating through from San Diego County would continue to be subject to the time slot restrictions imposed by continued single track segments, thus reducing the reliability that these services could maintain their time slots within the proposed HST service plan once they reach Anaheim. With the proposed frequency of the HST under the Phase 1 Service Plan, a statewide timetable that is contingent on single track windows (requiring “meets” on trains in San Diego County) does not provide the reliability required to ensure the success of the HST system.

Based on this analysis, which incorporated the Phase 1 Service Plan, it was determined that the Expanded Shared-Track Alternative does not adequately support the forecast volume of passenger trains at an acceptable level of performance/delay using the performance requirements.

3.7.4 Dedicated HST Alternative

Six mainline tracks, a combination of the HST line plus four conventional tracks from the LOSSAN Corridor Caltrans long range plan, were modeled between Redondo Junction and Fullerton Junction for the Dedicated HST Alternative, with four interconnected tracks shared among BNSF freight trains, and conventional passenger trains; Amtrak (Pacific Surfliner and Southwest Chief trains) and Metrolink (91/PVL and Orange County Line trains). Two interconnected tracks physically separated from the other four tracks were assumed in the Model for the HST, essentially defining one four track system and one two track system”. From Fullerton to Anaheim, four main tracks are assumed; two tracks for freight and conventional passenger trains and two tracks for the dedicated HST line.

The results of the simulation modeling and analysis indicated that two “dedicated” mainline tracks could feasibly support up to 12 HST per hour (both directions), which adequately addresses the operational requirements developed in the Phase 1 Service Plan. It was determined that the other four interconnected freight/conventional passenger main tracks provide sufficient capacity to feasibly support the forecast volume of both conventional freight and passenger rail services. Based on this analysis it was determined that this alternative adequately meets HST needs and is sufficient for Caltrans long range plans for other services. .

3.7.5 Summary

The Dedicated HST Alternative was identified as the only alternative capable of accommodating the peak demand forecast for all classes of train service at acceptable levels of reliability and on-time performance. The Program Level Shared Track and Expanded Shared Track Alternatives were screened from further consideration after it was determined that the shared use configuration assumed in these scenarios did not adequately meet the need for HST service and could not support the assumed future volume of freight or passenger trains (including HST) at an acceptable level of performance.

The Dedicated HST Alternative to be carried forward consists of two main HST tracks. This scenario was modeled with four conventional tracks to confirm future capacity between Fullerton and Redondo Junctions, and was able to accommodate the forecast train volumes in the corridor at an acceptable performance level. Given that the fourth conventional track and 30 Minute Metrolink service to Los Angeles are not currently funded and are not included in the No Project Alternative, the Dedicated HST

Alternative assumes maintenance of three main conventional tracks between Fullerton and Redondo Junctions. Space will also be identified that can be preserved for a fourth main track, which could be added by others in the future as conventional train volumes require.

3.8 PROJECT ALTERNATIVES ELIMINATED / CARRIED FORWARD

The Dedicated HST Alternative is the only HST alternative that would provide the capacity and performance of operations to meet the Phase 1 Service Plan of up to five high-speed trains per hour. Having two tracks exclusively for high-speed trains allows for higher-speed HST operations than the shared-track alternatives, and removes potential impacts from delayed Metrolink and Amtrak service. In addition, it provides for a safer environment (no mixing of FRA-Compliant and Non-Compliant trains), and does not require a waiver from the FRA.

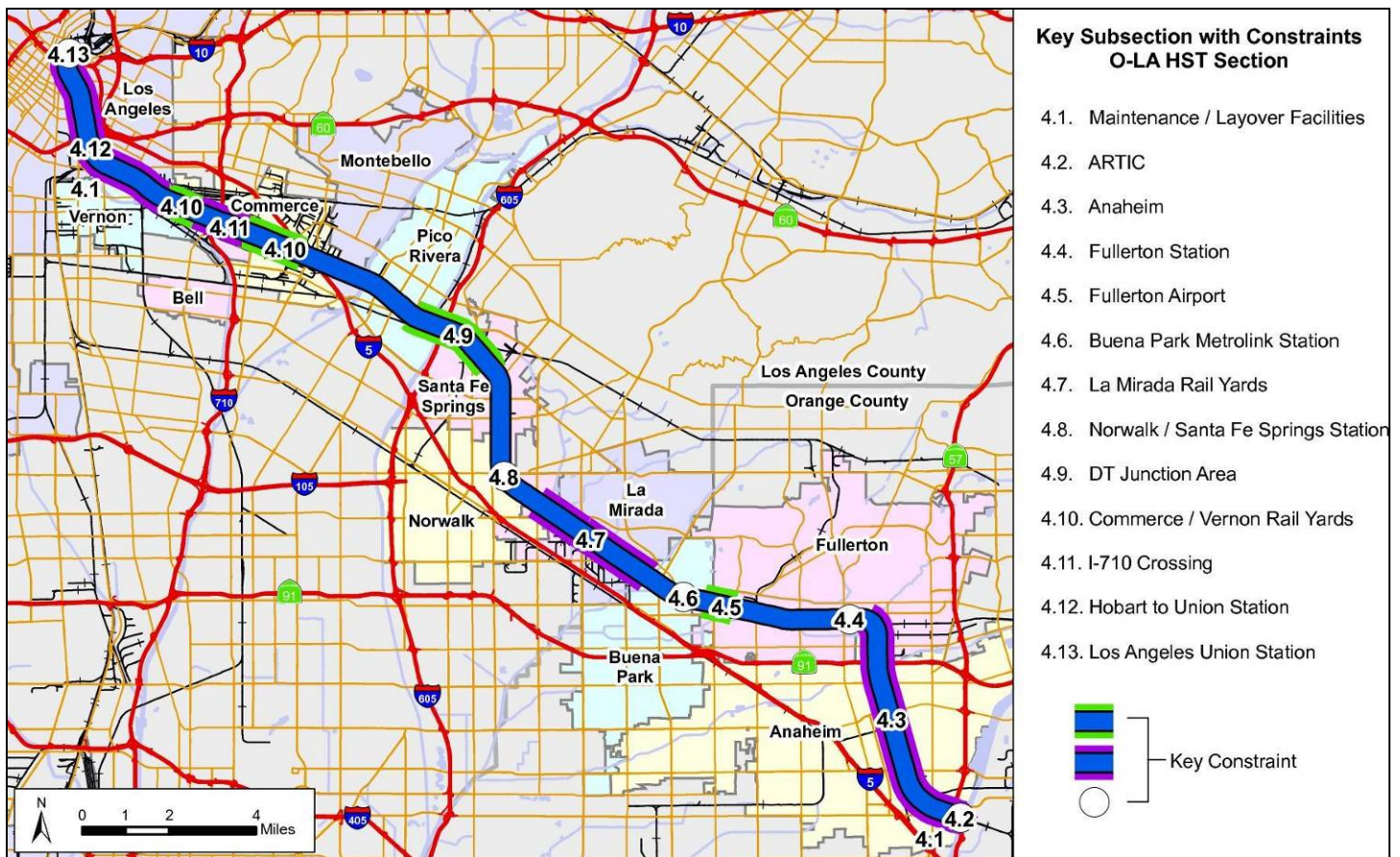
The largest impacts from the Dedicated HST alternative come from the need to acquire 25' of ROW through typical at-grade sections where the track has not been shifted (15 feet more than the Expanded Shared-Track Alternative). This additional ROW is generally industrial, but includes some residential areas in the southern sections of the project. Fewer stations are required for this alternative and those remaining are simpler than the Shared-Track Alternatives, as there isn't a need to serve different train types (local versus express, low platforms versus high platforms) at each station. Instead, the HST stations are generally stand-alone operations constructed next to or over the existing Metrolink and Amtrak stations.

Based on the results of the operations modeling and the uncertainty of obtaining an FRA waiver to allow shared track HST operations, and due to superior operating characteristics, only the Dedicated HST Alternative meets the project purpose and need. Furthermore, the potential impacts of the Dedicated HST Alternatives are similar to the Expanded Shared Track Alternative. Both the Program Level Shared Track and Expanded Shared Track Alternatives fail to meet the Project purpose and objectives and are not reasonable. The Program Level Shared Track and Expanded Shared Track are eliminated from further consideration and the Dedicated HST Alternative is carried forward into preliminary design and environmental review.

4.0 DEFINITION / EVALUATION OF SUBSECTION OPTIONS

This section focuses on further defining individual subsections of the Dedicated HST (Build) Alternative. These key subsections have non-typical configurations or several design options to address key constraints. They are shown in Figure 4.1, and described and evaluated in the following sections. All other subsections of the Dedicated HST (Build) Alternative between Anaheim and Los Angeles utilize the typical at-grade configuration as shown in Figure 3.27.

Figure 4.1. Anaheim to LA Section – Key Subsections with Constraints



4.1 MAINTENANCE / LAYOVER FACILITIES

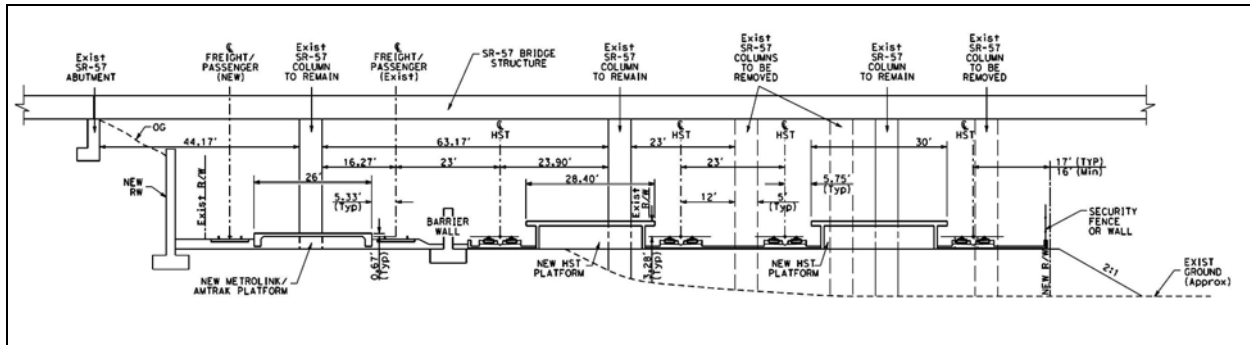
It is expected that two maintenance and layover facilities are needed for the HST Project along the A-LA section, one near the Anaheim Station and one near the Los Angeles Station. Options for siting these facilities are currently being studied, and will be analyzed in a separate technical memorandum.

4.2 ARTIC

The southern terminus of the A-LA HST project is located at the Anaheim Regional Transportation Intermodal Center (ARTIC). The ARTIC station design includes six (6) tracks and three (3) platforms configured as follows: four (4) HST tracks served by two (2) platforms; and two (2) Metrolink/Amtrak tracks served by one platform. The facilities are at-grade and portions of the platforms run underneath the SR-57 overpass and west of the Santa Ana River. ARTIC is being designed and environmentally analyzed as part of a separate project, so the HST project will only add service to the station. For more

information on ARTIC, see Section 3.3.1. The typical cross-section at ARTIC is shown in Figure 4.2. Plan and profile drawings for this section of the alignment are shown on Sheets 81 and 82 in Appendix E.

Figure 4.2. Typical Cross-Section – Anaheim Station (ARTIC)

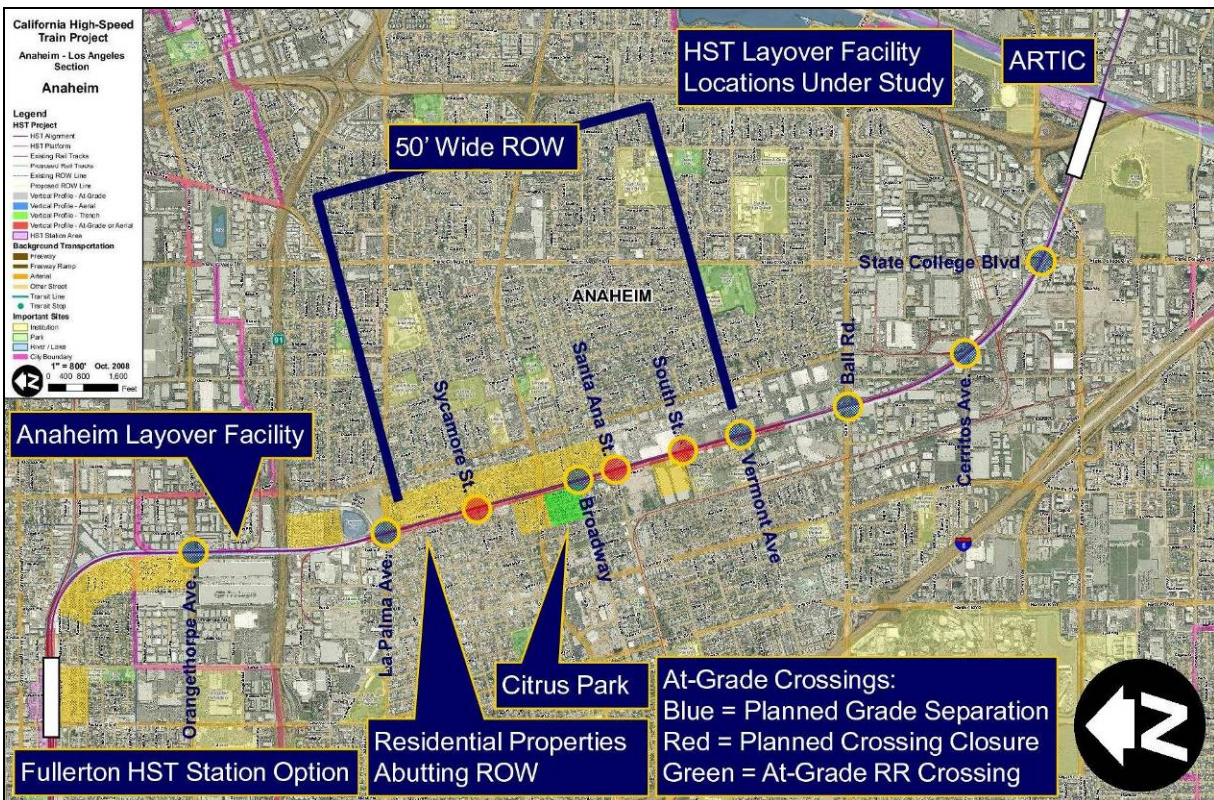


Source: STV Incorporated

4.3 ANAHEIM

The HST alignment through the City of Anaheim carries lower volumes of rail traffic than the Fullerton to Hobart Yard section because large numbers of BNSF freight trains serving the ports of Los Angeles and Long Beach split from the LOSSAN corridor at Fullerton Junction. An overview of the LOSSAN corridor through Anaheim is shown in Figure 4.3.

Figure 4.3. Anaheim Overview



Source: AE LLC, STV Incorporated

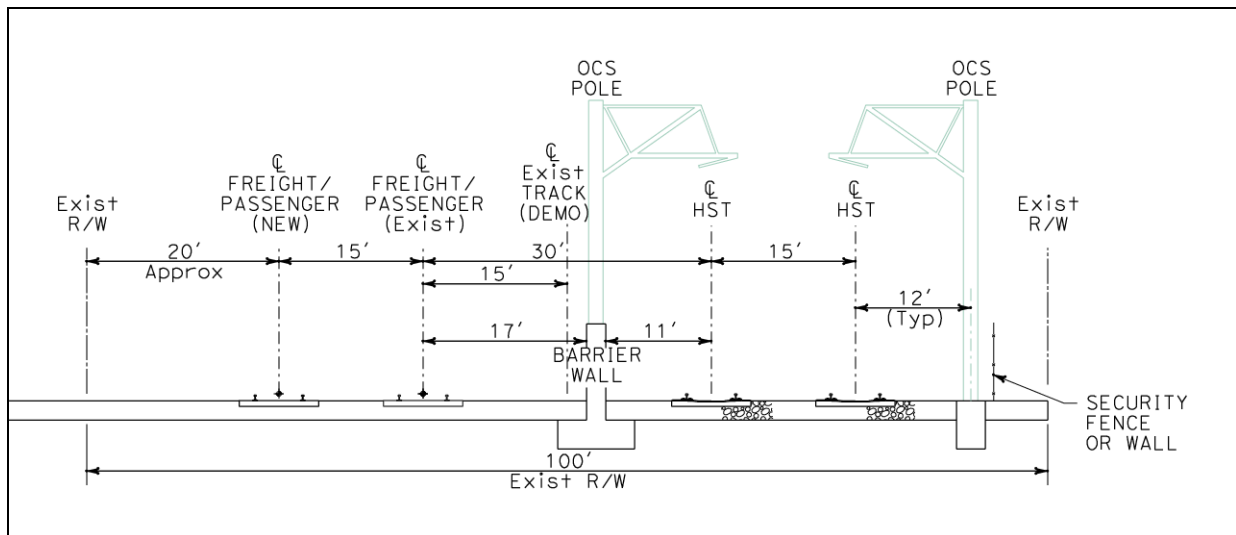
This subsection mainly carries Amtrak and Metrolink passenger trains, with only 5-10 local freight trains per day. The ROW is 50' wide through Anaheim between Vermont Avenue and North Street, and 100

feet wide otherwise. The Build Alternative requires that two additional tracks be constructed through Anaheim to carry high-speed trains in addition to the existing two LOSSAN corridor tracks. Since these two additional tracks cannot be fit into the existing 50' ROW, several options are examined for this subsection of the project. They include at-grade with ROW takes, aerial, cut-and-cover tunnel, and deep bore tunnel, and are discussed in the following sub-sections. For more detail on the Anaheim 50' ROW section, see the *Anaheim 50' ROW Technical Memorandum*.

The 1.5 mile long 50' wide section of ROW runs from Vermont Avenue in the south to North Street in the north (just south of La Palma Avenue). Land uses abutting the ROW are generally industrial south of Santa Ana Street in the 50' section, and generally residential to the north. Citrus Park and the Colony Historical District directly abut the western boundary of the ROW between Broadway and Lincoln Ave. Four roadways currently cross the LOSSAN corridor at-grade in this section (South Street, Santa Ana Street, Broadway, and Sycamore Street), with at-grade crossings at either end of the section as well (Vermont Ave to the south, La Palma Ave to the north). Lincoln Avenue crosses beneath the railroad tracks in an underpass structure near the center of the 50' wide section of ROW.

There are currently two railroad tracks in this section of the ROW, with one centered on the ROW and the second to the west. The typical No Build cross-section for this section is shown in Figure 3.15. The typical Build Alternative cross-section through the 100' wide section through Anaheim is shown in Figure 4.4.

Figure 4.4. Typical Cross-Section – Anaheim 100' ROW



Source: STV Incorporated

4.3.1 Grade Separations

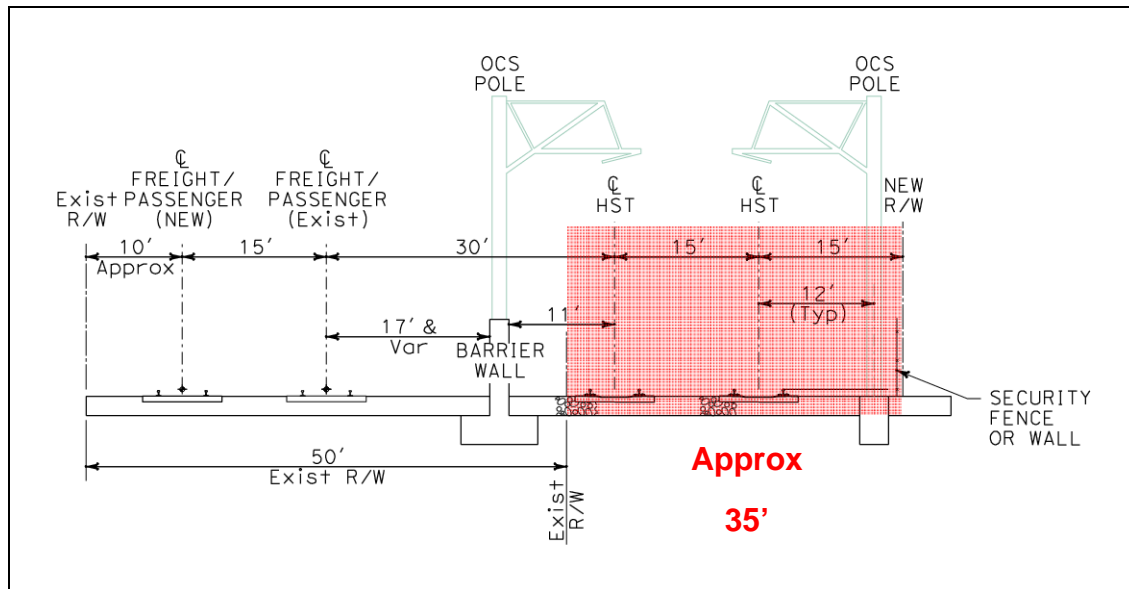
Given the high operating speeds of high-speed trains along the LOSSAN corridor, all highway crossings will need to be grade separated to ensure maximum safety for train passengers and auto drivers. The seven grade separations and three crossing closures proposed for the ten current at-grade crossings in Anaheim are discussed further in Section 3.4.1. Plans, profiles, cross-sections for the crossings are shown on Sheets 177-190 and 237-243 in Appendix E

4.3.2 At-Grade

The dedicated options will require two new tracks in addition to the two existing tracks to accommodate high-speed trains through Anaheim. In addition, to ensure safe at-grade operations in a mixed-use environment, a crash wall is needed to ensure separation between light, high-speed passenger trains and heavy freight trains. A four track plus crash wall configuration cannot be fit into the existing 50' ROW at-

grade, so approximately 35' of additional ROW will need to be procured for an at-grade dedicated option. A typical configuration for such an option is shown in Figure 4.5. Plan and profile drawings for this option are shown on Sheets 74 – 77 of Appendix E.

Figure 4.5. Typical Cross-Section – Anaheim 50' ROW – At-Grade Option



Source: STV Incorporated

4.3.3 Aerial

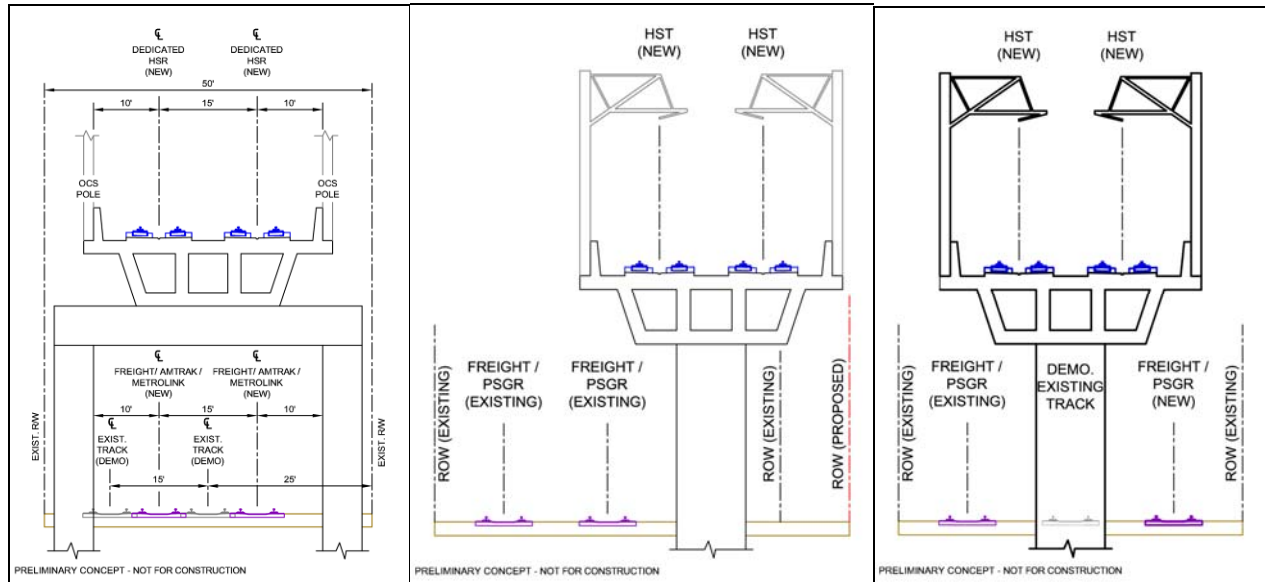
An alternative to acquiring ROW to build the two additional tracks needed for the Dedicated HST option is to build them within the existing ROW. Given that only three tracks can be fit into the ROW at-grade, aerial or tunnel structures would be needed to fit four tracks in the narrow ROW. This section describes the issues that arise from an aerial HST option.

There are several potential configurations for an aerial structure along the 50' section in Anaheim, as shown in Figure 4.6. One is to build the structure to the side of the existing tracks. Given the narrow width of the ROW and the wideness of the structure, it would overhang the existing ROW line and require easements along almost the entire length of the 50' section. Another potential configuration is to build columns near the existing ROW lines and locate the new tracks above the existing tracks on a straddle-bent structure. This would require more complicated structures at the columns and connections to the guideway, as well as have an aesthetic/visual impact because of the additional columns and straddle-beams.

The option studied further in this section is to build the structure in the center of the ROW on a single line of columns, with the existing tracks pushed to the outside of the ROW. This option will require the relocation of one of the existing tracks, but will fit within the existing ROW. The central pier may require additional protection from the two adjacent at-grade tracks.

Since the HST tracks are on an aerial structure, grade separations of the existing at-grade tracks will not be included as part of the HST project.

Figure 4.6. Typical Cross-Section – Anaheim 50' ROW – Aerial Options



Source: STV Incorporated

4.3.4 Cut-and-Cover Tunnel

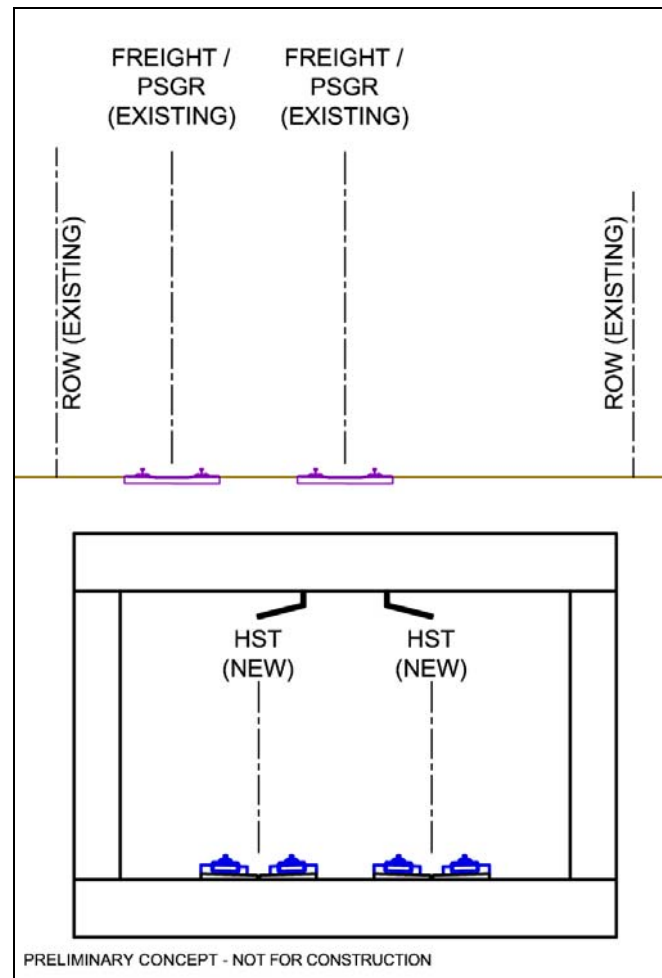
An alternative to an aerial structure for the constrained ROW segment in Anaheim is a tunnel. There are several options for a tunnel, including a shallow tunnel cut from the surface and a deep tunnel bored using tunnel boring machines. This section details the shallow cut-and-cover tunnel option.

A cut-and-cover tunnel will place the two additional tracks needed for HST service underground, while preserving the two existing at-grade tracks. This would limit environmental impacts to the surrounding community outside of the construction staging area, but would introduce significant constructability issues.

A major issue of concern for this option is grade separations. The HST tracks, since they are in a tunnel, are grade separated from street traffic once completed. But the existing at-grade tracks, which will carry Amtrak, Metrolink, and BNSF service, will still have at-grade crossings. Road overpass structures are needed to grade separate these crossings in the future, as underpasses will force the HST tracks to a very deep vertical profile. These overpasses, which will lie in the heart of several neighborhoods, will have major impacts to surrounding neighborhoods and cut off street access for several hundred feet on either side of the railroad tracks.

Another complication is the existing roadway underpass at Lincoln Avenue. The trench would pass directly through where the roadway is currently located, so the crossing would need to be converted into an overpass (for a change in roadway vertical elevation of roughly 60 feet). This presents very challenging constructability issues. A typical cross-section for this option is shown in Figure 4.7.

Figure 4.7. Typical Cross-Section – Anaheim – Cut-and-Cover Tunnel Option

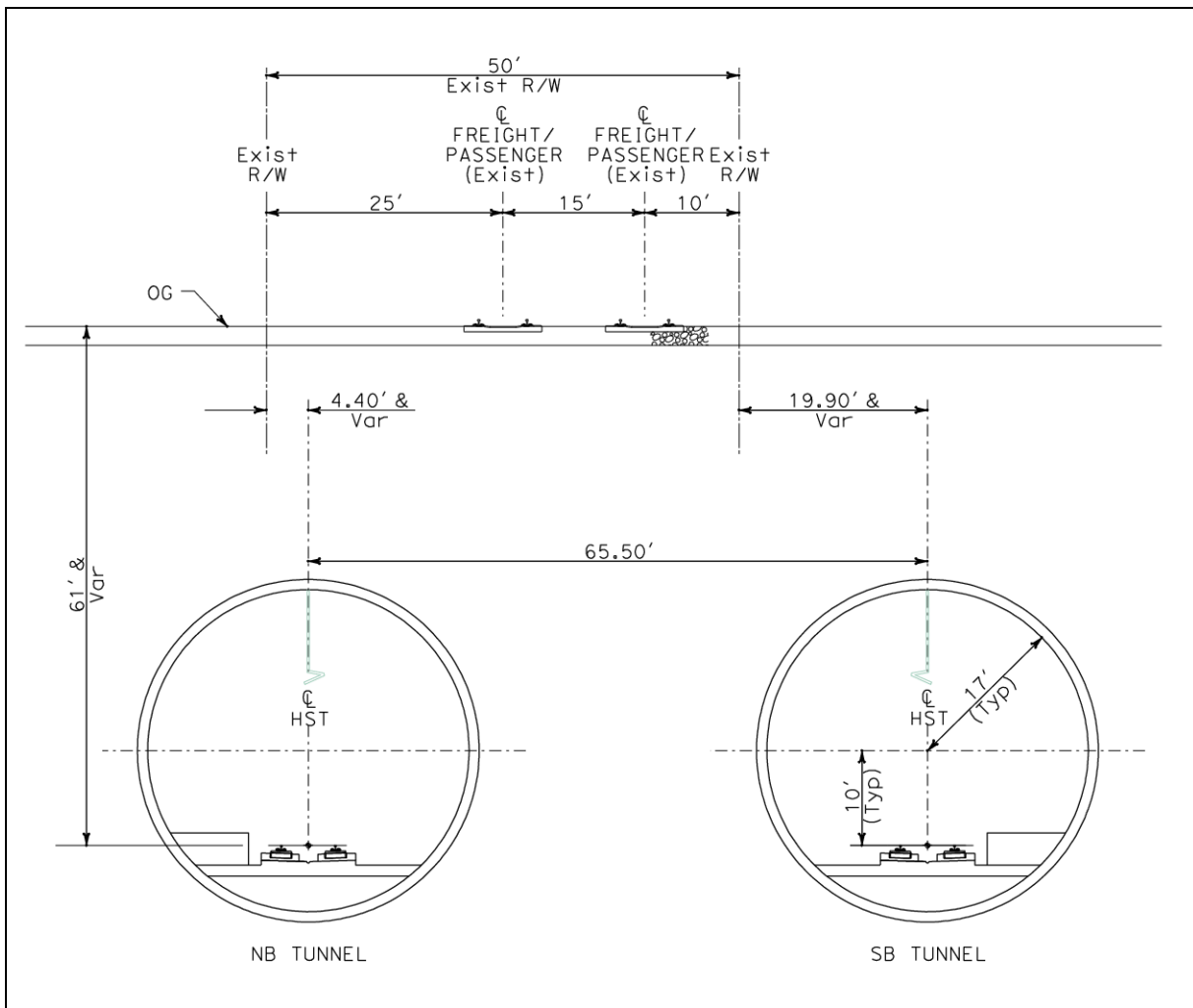


Source: STV Incorporated

4.3.5 Deep Bore Tunnel

A final option examined for this stretch of ROW is to use a bored tunnel to bypass the many constraints through the 50' ROW. With tunnel portals in industrial areas near SR-91 to the north and Ball Road to the south, the proposed tunnel would run directly underneath the existing ROW at roughly 40-45' deep. The option discussed assumes twin bore tunnels, but a single larger-diameter tunnel is also an option. A typical cross-section for this option is shown in Figure 4.8. Plan and profile information for the option are shown on Sheets 106 – 113 of Appendix E.

Figure 4.8. Typical Cross-Section – Anaheim – Deep Bore Tunnel Option



Source: STV Incorporated

4.3.6 Evaluation Table – Anaheim 50' ROW Options

Evaluation Measure	At-Grade	Aerial
Ridership / Revenue Potential	No difference in operating speeds for options in this sub-section. No differential in ridership / revenue potential expected.	
Intermodal Connections	No stations proposed in this subsection.	
Capital Costs	At-grade construction second least expensive for 4-tracks, but large ROW and grade separation costs. Approx \$171 million	Aerial structure least expensive option. Approx. \$115 million
Operating Costs	At-grade option expected to have lowest operating costs due to lack of major structures to maintain.	Slightly higher operating costs expected compared to at-grade option due to maintenance obligations for aerial structure.
Operations Issues	No difference in operating speeds for options in this sub-section.	
Station Area Development Potential	No stations proposed in this subsection.	
Consistency with Other Planning Efforts	No other planning efforts identified in this sub-section.	
Constructability	Main constructability issues are adding grade separations and electrifying tracks while continuing to operate freight and passenger service. Acquisition of additional 35' of	Aerial structure are difficult to construct above existing trackwork while maintain railroad operations. This section of the corridor currently carries over 40

Evaluation Measure	At-Grade	Aerial
	<p>ROW will allow for easier staging of construction. Shoo-fly tracks can be built on acquired ROW while new bridges are constructed at grade crossings.</p>	<p>Metrolink and Amtrak trains per day, with service expanding to nearly 100 trains per day by the forecast year. Two tracks without operating constraints are required during construction to be able to maintain current levels of service, but this is not possible within existing ROW. Additional ROW would be required to accommodate the shoo-fly tracks. These tracks would be installed and put into service during construction. The existing grade crossings would need to be modified to accommodate the shoo-fly tracks. After construction these tracks would be removed. At best, one track can be kept operating without speed restrictions during construction, or two tracks with speed restrictions due to the proximity of construction activities and equipment. Construction activities will need to be concentrated during nighttime to minimize impacts to rail operations, but such activity would have significant noise impacts on surrounding residential communities. Additional ROW could alleviate constructability issues, but would compromise purpose of aerial option (to minimize ROW impacts).</p>
<p>Displacements / Property Access Impacts</p>	<p>Approx. 35' wide ROW takes are needed along the west side of the corridor between Vermont Ave. to the south and North St. to the north. Adjacent to the west side of the 50' ROW there are approx. 1.5 miles of industrial property takes, 0.7 miles of residential takes, and a 0.2 mile park take.</p> <p>Starting in the south, between Vermont Ave. and South St. there are three industrial buildings that are within the ROW take area. The southern two buildings immediately abut on the ROW and would lose approximately 35' of building area (approx. 20% of the entire buildings). The northern most building has about a 15' setback from the ROW and would lose approximately 20' of building area (approx. 20% of the entire building). There is also a parking area that would lose approximately 35' of space and between 20 and 30 parking spaces.</p> <p>North of South Street, the ROW abuts recently constructed high-density residential units. Parking and auto access are constructed directly adjacent to the ROW, with the approximately 35' wide ROW take focused on these areas. But, additional ROW will be required elsewhere to replace the affected parking and auto access areas. Between South St. and Santa Ana St. there are three industrial buildings with parking spaces and storage area. The southern building is new and is set back from the ROW approximately 30 to 35 feet. Loading areas run along the eastern side of the building. The loading areas would be lost and it is uncertain if the building would be affected. Just to the north of this building is a parking lot that would lose approximately 35' of space and between 40 and 50 parking spaces. North of the parking lot is a smaller older industrial building with a storage area to the north of it that would probably require a take of the entire property.</p> <p>Between Santa Ana St. and Broadway there are three industrial buildings with parking spaces and storage area. The southernmost building is sufficiently setback so as not to be affected, but it would lose the storage area it has between the building and the ROW. The industrial building immediately to the north abuts on the ROW and it would lose approximately 35' of building area (approx. 33% of the entire building). Just to the north of this building is a parking lot that would lose approximately 35' of space and between 20 and 30 parking spaces. North of the parking</p>	<p>Placing an aerial structure within the center of the 50' ROW would require relocating the existing easternmost track to the east and closer to the eastern edge of the ROW. Columns would be constructed within the area vacated by the track relocation.</p> <p>Between Vermont Ave. and South St. there are four industrial buildings and associated parking and storage areas. Relocating the track to the eastern portion of the ROW would not affect the industrial uses along this section of the 50' ROW.</p> <p>Between South St. and Santa Ana St. there is an industrial building that immediately abut on the ROW and a parking area for large trailers. Relocating the track to the eastern portion of the ROW would not affect the industrial uses along this section of the 50' ROW.</p> <p>Between Santa Ana St. and Broadway there are residential apartments with a property line that immediately abuts on the ROW. Relocating the track to the eastern portion of the ROW would not affect the residential uses along this section of the 50' ROW.</p> <p>Between Broadway and Lincoln Ave. there is a residential apartment building and SF houses with property lines that immediately abut on the ROW. Relocating the track to the eastern portion of the ROW would not affect the residential uses along this section of the 50' ROW.</p> <p>Between Lincoln Ave. and Cypress St. there is landscaped open space area immediately adjacent to the ROW. Relocating the track to the eastern portion of the ROW would not affect the landscaped areas along this section of the 50' ROW.</p> <p>Between Cypress St. and Sycamore St. there are residential apartments with property lines that immediately abut on the ROW. Relocating the track to the eastern portion of the ROW would not affect the residential uses along this section of the 50' ROW.</p> <p>Between Sycamore St. and Wilhelmina St. there are an industrial building and associated parking lot and four SF houses with property lines that immediately abut on the ROW. Relocating the track to the eastern portion of the</p>

Evaluation Measure	At-Grade	Aerial
	<p>lot is an industrial building that is setback approximately 20' from the ROW, and thus approximately 15' of building area would be taken (approx. 15% of the entire building).</p> <p>Between Broadway and Lincoln Ave. there is a mini park (Citrus Park) and associated parking lot, and the Y Children's Station (located in the former UP Railroad Station building). The park would lose a 35' wide strip of land along the ROW (approximately 30% of the park's land area), and approximately 5 parking spaces. The Y Children's Station building would be a total take. The park land lost to the widening could be recouped on the excess land gained by the take of the Y Children's Station property. Between Lincoln Ave. and Cypress St. there are four single family (SF) houses that are set back approximately 20' from the ROW (location of their backyard fence). The two southern SF houses are separated from the two northern SF houses by a private mini park with tot lot and basketball court uses. The 35' ROW widening would take the entire backyard of the southernmost SF house, which has about 15' of backyard area. This would place the back wall of the house immediate to the property line, thus this would have a potential to take this SF house. The other three SF houses have larger backyards and would lose about 15' feet of area, but keeping 20' of backyard between the house and the property line. The tot lot and basketball court would have to be relocated on the private park area.</p> <p>Between Cypress St. and Adele St. there is an industrial use that immediately abuts the ROW. The land closest to the ROW is used for parking / storage. The closest point of the building is set back from the property line by approximately 35'. It appears that the 35' widening would only remove eastern most parking / storage area; there appears to be ample parking / storage area on the west side of the building.</p> <p>Between Adele St. and Sycamore St. there are two industrial uses separated by an alley. The southernmost of these two uses abuts the ROW and the 35' widening would require the taking of this property. The northern industrial use has one building and parking / storage area within the 35' widening area. The building appears to be a storage building. This use should be able to continue in operation after the widening.</p> <p>Between Sycamore St. and Wilhelmina St. there is one long industrial building that abuts the ROW. The 35' widening would require the taking of this property.</p> <p>Between Wilhelmina St. and North St. there is an RV storage facility. The 35' widening would require the taking of this property.</p> <p>Limited ROW takes needed at grade separations to preserve access to properties facing lowered streets.</p>	<p>ROW would not affect the industrial or residential uses along this section of the 50' ROW.</p> <p>Between Wilhelmina St. and North St. there are residential apartments with property lines abutting on the ROW. Relocating the track to the eastern portion of the ROW would not affect the residential uses along this section of the 50' ROW.</p> <p>Limited ROW takes needed at grade separations to preserve access to properties facing lowered streets.</p> <p>The temporary ROW impacts associated with the shoofly tracks are very similar to those of the at-grade dedicated option.</p>
Traffic Impacts	Grade separations will improve traffic circulation across corridor. Temporary traffic impacts at grade separations during construction. Crossing closures will shift traffic to adjacent separated crossings. Minor reconfigurations of connecting streets at grade separations.	The aerial structures would span the local streets within the 50' ROW. No changes to traffic circulation would occur.
Waterways / Sensitive Habitat Areas	There are no waterways or sensitive habitat areas within the 50' ROW. No impacts to these resources would occur.	
Cultural Resources	The 50' ROW forms the eastern boundary of the National Register of Historic Places Anaheim Colony Historical District (ACHD). The National Register of Historic Places	Potential construction and operational impacts from an aerial structure through the ACHD could include: visual (aesthetic), and noise and vibration. These potential

Evaluation Measure	At-Grade	Aerial
	recognizes the boundaries of the ACHD as being Harbor Blvd., Sycamore St., the Santa Fe Railroad ROW, and Santa Ana St. Potential construction and operational impacts to the ACHD could include: displacements (property takes), visual (aesthetic), and noise and vibration. These potential impacts are addressed in their corresponding discussions.	impacts are addressed in their corresponding discussions.
Parklands	Between Broadway and Lincoln Ave. there is a mini park (Citrus Park). The park would lose a 35' wide strip of land along the ROW (approximately 30% of the park's land area), and approximately 5 parking spaces. To the north of the park is The Y Children's Station building which would be a total take. The park land lost to the widening could be recouped on the excess land gained by the take of the Y Children's Station property.	Potential impacts to parklands which could occur from an aerial structure include: visual (aesthetic), and noise and vibration. These potential impacts are addressed in their corresponding discussions.
Agricultural Lands	There are no agricultural lands within the 50' wide ROW area.	
Noise / Vibration	<p>Passby noise levels of an at-grade high-speed train operating at 125 mph would be approximately 3 dB less than an at-grade diesel operated Amtrak or Metrolink train at 80 mph.</p> <p>The following parks and residential buildings are adjacent to the ROW and are affected by wayside noise and ground vibration during construction and from HST operations:</p> <p>Between Broadway and Lincoln Ave. there is a mini park (Citrus Park) and associated parking lot, and the Y Children's Station (located in the former UP Railroad Station building) along the western side of the ROW and one apartment building and eleven SF houses along the eastern side of the ROW. The Y Children's Station building would be a total take.</p> <p>Between Lincoln Ave. and Cypress St. there are four single family (SF) houses along the western side of the ROW and a landscaped open space area along the eastern side of the ROW.</p> <p>Between Cypress St. and Sycamore St. there are twelve apartment buildings along the eastern side of the ROW.</p> <p>Between Sycamore St. and Wilhelmina St. there is one long industrial building that abuts the ROW along the western side of the ROW and twelve apartment buildings along the eastern side of the ROW.</p> <p>Between Wilhelmina St. and North St. there is an RV storage facility along the western side of the ROW and eleven apartment buildings along the eastern side of the ROW.</p>	<p>A high-speed train operating at 125 mph on aerial structure would have the same passby noise level as a diesel operated Amtrak or Metrolink train traveling at 80 mph at grade.</p> <p>The following parks and residential buildings are adjacent to the ROW and are affected by wayside noise and ground vibration during construction and from HST operations:</p> <p>Between Broadway and Lincoln Ave. there is a mini park (Citrus Park) and associated parking lot, and the Y Children's Station (located in the former UP Railroad Station building) along the western side of the ROW and one apartment building and eleven SF houses along the eastern side of the ROW.</p> <p>Between Lincoln Ave. and Cypress St. there are four single family (SF) houses along the western side of the ROW and a landscaped open space area along the eastern side of the ROW.</p> <p>Between Cypress St. and Sycamore St. there are twelve apartment buildings along the eastern side of the ROW.</p> <p>Between Sycamore St. and Wilhelmina St. there is one long industrial building that abuts the ROW along the western side of the ROW and twelve apartment buildings along the eastern side of the ROW.</p> <p>Between Wilhelmina St. and North St. there is an RV storage facility along the western side of the ROW and eleven apartment buildings along the eastern side of the ROW.</p>
Visual / Scenic Resources	<p>Starting in the south between Vermont Ave. and South St. there are three industrial buildings along the western side of the ROW and five industrial buildings along the eastern side of the ROW. Potential construction and operational aesthetic and visual impacts would not affect these industrial uses.</p> <p>Between South St. and Santa Ana St. there are two industrial buildings along the western side of the ROW and one industrial building along the eastern side of the ROW. Potential construction and operational aesthetic and visual impacts would not affect these industrial uses.</p> <p>Between Santa Ana St. and Broadway there are three industrial buildings along the western side of the ROW and six apartment buildings along the eastern side of the ROW. Potential construction and operational aesthetic</p>	<p>Between Vermont Ave. and South St. there are three industrial buildings along the western side of the ROW and five industrial buildings along the eastern side of the ROW. Potential construction and operational aesthetic and visual impacts would not affect these industrial uses.</p> <p>Between South St. and Santa Ana St. there are two industrial buildings along the western side of the ROW and one industrial building along the eastern side of the ROW. Potential construction and operational aesthetic and visual impacts would not affect these industrial uses.</p> <p>Between Santa Ana St. and Broadway there are three industrial buildings along the western side of the ROW and six apartment buildings along the eastern side of the ROW. Potential construction and operational aesthetic and visual impacts would not affect the industrial uses, but</p>

Evaluation Measure	At-Grade	Aerial
	<p>and visual impacts would not affect the industrial uses, but there would be an impact to the residential uses.</p> <p>Between Broadway and Lincoln Ave. there is a mini park (Citrus Park) and associated parking lot, and the Y Children's Station (located in the former UP Railroad Station building) along the western side of the ROW and one apartment building and eleven SF houses along the eastern side of the ROW. The Y Children's Station building would be a total take. Potential construction and operational aesthetic and visual impacts would affect both the park uses and the residential uses.</p> <p>Between Lincoln Ave. and Cypress St. there are four single family (SF) houses along the western side of the ROW and a landscaped open space area along the eastern side of the ROW. Potential construction and operational aesthetic and visual impacts would affect both the residential uses and the landscaped open space area.</p> <p>Between Cypress St. and Sycamore St. there are three industrial uses along the western side of the ROW and twelve apartment buildings along the eastern side of the ROW. Potential construction and operational aesthetic and visual impacts would not affect the industrial uses but the residential uses would be affected.</p> <p>Between Sycamore St. and Wilhelmina St. there is one long industrial building that abuts the ROW along the western side of the ROW and twelve apartment buildings along the eastern side of the ROW. Potential construction and operational aesthetic and visual impacts would not affect the industrial use but the residential uses would be affected.</p> <p>Between Wilhelmina St. and North St. there is an RV storage facility along the western side of the ROW and eleven apartment buildings along the eastern side of the ROW. Potential construction and operational aesthetic and visual impacts would not affect the RV storage facility but the residential uses would be affected.</p>	<p>there would be an impact to the residential uses.</p> <p>Between Broadway and Lincoln Ave. there is a mini park (Citrus Park) and associated parking lot, and the Y Children's Station (located in the former UP Railroad Station building) along the western side of the ROW and one apartment building and eleven SF houses along the eastern side of the ROW. Potential construction and operational aesthetic and visual impacts would affect the Y Children's Station, the park uses and the residential uses.</p> <p>Between Lincoln Ave. and Cypress St. there are four single family (SF) houses along the western side of the ROW and a landscaped open space area along the eastern side of the ROW. Potential construction and operational aesthetic and visual impacts would affect both the residential uses and the landscaped open space area.</p> <p>Between Cypress St. and Sycamore St. there are three industrial uses along the western side of the ROW and twelve apartment buildings along the eastern side of the ROW. Potential construction and operational aesthetic and visual impacts would not affect the industrial uses but the residential uses would be affected.</p> <p>Between Sycamore St. and Wilhelmina St. there is one long industrial building that abuts the ROW along the western side of the ROW and twelve apartment buildings along the eastern side of the ROW. Potential construction and operational aesthetic and visual impacts would not affect the industrial use but the residential uses would be affected.</p> <p>Between Wilhelmina St. and North St. there is an RV storage facility along the western side of the ROW and eleven apartment buildings along the eastern side of the ROW. Potential construction and operational aesthetic and visual impacts would not affect the industrial use but the residential uses would be affected.</p>
Geologic / Soil Constraints	There are no known geologic or soils constraints within the 50' ROW area.	There is a potential for aerial foundation issues within the 50' ROW.
Hazardous Materials	<p>Starting in the south between Vermont Ave. and South St. there are three industrial buildings along the western side of the ROW and five industrial buildings along the eastern side of the ROW. Potential hazardous materials and waste impacts could be associated with these industrial uses.</p> <p>Between South St. and Santa Ana St. there are two industrial buildings along the western side of the ROW and one industrial building along the eastern side of the ROW. Potential hazardous materials and waste impacts could be associated with these industrial uses.</p> <p>Between Santa Ana St. and Broadway there are three industrial buildings along the western side of the ROW and six apartment buildings along the eastern side of the ROW. Potential hazardous materials and waste impacts could be associated with these industrial uses, but there would not be an impact associated with the residential uses.</p> <p>Between Broadway and Lincoln Ave. there is a mini park (Citrus Park) and associated parking lot, and the Y Children's Station (located in the former UP Railroad</p>	<p>Starting in the south between Vermont Ave. and South St. there are three industrial buildings along the western side of the ROW and five industrial buildings along the eastern side of the ROW. Potential hazardous materials and waste impacts could be associated with these industrial uses.</p> <p>Between South St. and Santa Ana St. there are two industrial buildings along the western side of the ROW and one industrial building along the eastern side of the ROW. Potential hazardous materials and waste impacts could be associated with these industrial uses.</p> <p>Between Santa Ana St. and Broadway there are three industrial buildings along the western side of the ROW and six apartment buildings along the eastern side of the ROW. Potential hazardous materials and waste impacts could be associated with these industrial uses, but there would not be an impact associated with the residential uses.</p> <p>Between Broadway and Lincoln Ave. there is a mini park (Citrus Park) and associated parking lot, and the Y Children's Station (located in the former UP Railroad</p>

Evaluation Measure	At-Grade	Aerial
	<p>Station building) along the western side of the ROW and one apartment building and eleven SF houses along the eastern side of the ROW. The Y Children's Station building would be a total take. Potential hazardous materials and waste impacts would not be associated with the park uses and the residential uses.</p> <p>Between Lincoln Ave. and Cypress St. there are four single family (SF) houses along the western side of the ROW and a landscaped open space area along the eastern side of the ROW. Potential hazardous materials and waste impacts would not be associated with the residential uses and the landscaped open space area.</p> <p>Between Cypress St. and Sycamore St. there are three industrial uses along the western side of the ROW and twelve apartment buildings along the eastern side of the ROW. Potential hazardous materials and waste impacts could be associated with the industrial uses but not with the residential uses.</p> <p>Between Sycamore St. and Wilhelmina St. there is one long industrial building that abuts the ROW along the western side of the ROW and twelve apartment buildings along the eastern side of the ROW. Potential hazardous materials and waste impacts could be associated with the industrial uses but not with the residential uses.</p> <p>Between Wilhelmina St. and North St. there is an RV storage facility along the western side of the ROW and eleven apartment buildings along the eastern side of the ROW. Potential hazardous materials and waste impacts could be associated with the RV storage facility but not with the residential uses.</p>	<p>Station building) along the western side of the ROW and one apartment building and eleven SF houses along the eastern side of the ROW. Potential hazardous materials and waste impacts would not be associated with the building and associated parking lot, and the Y Children's Station, the park uses, and the residential uses.</p> <p>Between Lincoln Ave. and Cypress St. there are four single family (SF) houses along the western side of the ROW and a landscaped open space area along the eastern side of the ROW. Potential hazardous materials and waste impacts would not be associated with the residential uses and the landscaped open space area.</p> <p>Between Cypress St. and Sycamore St. there are three industrial uses along the western side of the ROW and twelve apartment buildings along the eastern side of the ROW. Potential hazardous materials and waste impacts could be associated with the industrial uses but not with the residential uses.</p> <p>Between Sycamore St. and Wilhelmina St. there is one long industrial building that abuts the ROW along the western side of the ROW and twelve apartment buildings along the eastern side of the ROW. Potential hazardous materials and waste impacts could be associated with the industrial uses but not with the residential uses.</p> <p>Between Wilhelmina St. and North St. there is an RV storage facility along the western side of the ROW and eleven apartment buildings along the eastern side of the ROW. Potential hazardous materials and waste impacts could be associated with the RV storage facility but not with the residential uses.</p>

Evaluation Measure	Cut-and-Cover Tunnel	Deep Bore Tunnel
Ridership / Revenue Potential	No difference in operating speeds for options in this sub-section. No differential in ridership / revenue potential expected.	
Intermodal Connections	No stations proposed in this subsection.	
Capital Costs	Cut-and-cover tunnel less expensive than deep bore tunnel, more expensive than at-grade or aerial options Approx. \$324 million	Deep bore tunnel most expensive option. Approx. \$411 million
Operating Costs	Additional operating / maintenance costs for tunnels as compared to at-grade and aerial options due to ventilation, lighting, emergency access / egress, monitoring of operations, and other operating activities.	
Operations Issues	No difference in operating speeds for options in this sub-section.	
Station Area Development Potential	No stations proposed in this subsection.	
Consistency with Other Planning Efforts	No other planning efforts identified in this sub-section.	
Constructability	Cut and cover tunnel is extremely difficult to construct below existing railroad while maintaining rail operations. This section of the corridor currently carries over 40 Metrolink and Amtrak trains per day, with service expanding to nearly 100 trains per day by the forecast year. Two tracks without operating constraints are required during construction to be able to maintain current levels of service, but this is not possible within existing ROW. At best, one track can be kept operating without speed restrictions during construction, or two tracks with speed restrictions due to the proximity of construction activities and equipment. Construction activities will need to be concentrated during nighttime to minimize impacts to rail operations, but such activity would have significant noise impacts on surrounding	<p>Most construction issues affecting existing services are near portal areas, where enough ROW is acquired to minimize these impacts. Difficult but straightforward tunnel boring operation.</p> <p>Complicated logistics will result in disposing of the earth removed during construction activities. If the earth removed is loaded into a train for hauling to a disposal site, a loading facility and new temporary industrial track will need to be constructed. This loading facility may require additional ROW to construct and operate. It will also have significant noise, vibration and light impacts. If the earth removed is hauled away on truck, there are significant roadway, traffic levels, air (dust) and noise impacts.</p>

Evaluation Measure	Cut-and-Cover Tunnel	Deep Bore Tunnel
	<p>residential communities. Additional ROW could alleviate constructability issues, but would compromise purpose of cut-and-cover tunnel option (to minimize ROW impacts).</p> <p>Complicated logistics will result in disposing of the earth removed during construction activities. If the earth removed is loaded into a train for hauling to a disposal site, a loading facility and new temporary industrial track will need to be constructed. This loading facility may require additional ROW to construct and operate. It will also have significant noise, vibration and light impacts. If the earth removed is hauled away on truck, there are significant roadway, traffic levels, and air quality and noise impacts.</p> <p>Would require complete replacement of existing Lincoln Avenue undercrossing, as it would be in path of HST structure. This is not feasible without closure of Lincoln Blvd for extended period (large traffic impacts) or extensive ROW takes (which would compromise purpose of cut-and-cover tunnel option – to minimize ROW impacts).</p>	
Displacements / Property Access Impacts	HST tracks can be fit into existing ROW underneath existing tracks.	Staging areas will require ROW takes at either end of 50' section. These areas are in the vicinity of Vermont and La Palma Avenues in primarily industrial areas, requiring the take of several warehouses for each approximately 5 acre area. Bored tunnel can be constructed below existing ROW, with underground easements needed to either side of existing ROW.
Traffic Impacts	<p>During construction there would be street closures as the cut-and-cover tunnel is constructed within each of the streets that cross the 50' ROW. All cross streets between Vermont Ave. in the south and North St. in the north would be affected.</p> <p>During operation there would be no traffic impacts within the 50' ROW.</p>	<p>During construction there would be street closures in the areas of the two portals and impacts to local traffic circulation due to the movement of haul trucks and other construction vehicles within the 50' ROW area.</p> <p>During operation there would be no traffic impacts within the 50' ROW area.</p>
Waterways / Sensitive Habitat Areas	There are no waterways or sensitive habitat areas within the 50' ROW. No impacts to these resources would occur.	There are no waterways or sensitive habitat areas within the 50' ROW. No impacts to these resources would occur.
Cultural Resources	The 50' ROW forms the eastern boundary of the National Register of Historic Places Anaheim Colony Historical District (ACHD). The National Register of Historic Places recognizes the boundaries of the ACHD as being Harbor Blvd., Sycamore St., the Santa Fe Railroad ROW, and Santa Ana St. Potential construction and operational impacts to the ACHD could include: displacements (property takes), visual (aesthetic), and noise and vibration. These potential impacts are addressed in their corresponding discussions.	Potential construction and operational impacts from a deep bore tunnel through the ACHD could include: visual (aesthetic), and noise and vibration. These potential impacts are addressed in their corresponding discussions. The portals and the staging areas would be located outside the ACHD.
Parklands	Citrus Park is located on the west side of the 50' ROW. During construction adjacent to the park there is a potential that activities within the park could be interrupted.	Citrus Park would not be impacted during construction or operation of a deep bore tunnel.
Agricultural Lands	There are no agricultural lands within the 50' wide ROW area.	
Noise / Vibration	<p>Starting in the south between Vermont Ave. and South St. there are three industrial buildings along the western side of the ROW and five industrial buildings along the eastern side of the ROW. Potential construction noise and vibration impacts could affect these industrial uses. Potential operation vibration impacts could affect these industrial uses.</p> <p>Between South St. and Santa Ana St. there are two industrial buildings along the western side of the ROW and one industrial building along the eastern side of the ROW.</p>	<p>Construction and operation of a deep bore tunnel would not cause noise impacts within this 50' ROW section of track. Noise impacts would be outside this area and be associated with the portals and construction staging areas.</p> <p>Starting in the south between Vermont Ave. and South St. there are three industrial buildings along the western side of the ROW and five industrial buildings along the eastern side of the ROW. Potential construction and operation vibration impacts could affect these industrial uses.</p>

Evaluation Measure	Cut-and-Cover Tunnel	Deep Bore Tunnel
	<p>Potential construction noise and vibration impacts could affect these industrial uses. Potential operation vibration impacts could affect these industrial uses.</p> <p>Between Santa Ana St. and Broadway there are three industrial buildings along the western side of the ROW and six apartment buildings along the eastern side of the ROW. Potential construction noise and vibration impacts could affect these industrial uses. Potential operation vibration impacts could affect these industrial uses.</p> <p>Between Broadway and Lincoln Ave. there is a mini park (Citrus Park) and associated parking lot, and the Y Children's Station (located in the former UP Railroad Station building) along the western side of the ROW and one apartment building and eleven SF houses along the eastern side of the ROW. The Y Children's Station building would be a total take. Potential construction noise and vibration impacts could affect these industrial uses. Potential operation vibration impacts could affect these industrial uses.</p> <p>Between Lincoln Ave. and Cypress St. there are four single family (SF) houses along the western side of the ROW and a landscaped open space area along the eastern side of the ROW. Potential construction noise and vibration impacts could affect these industrial uses. Potential operation vibration impacts could affect these industrial uses.</p> <p>Between Cypress St. and Sycamore St. there are three industrial use along the western side of the ROW and twelve apartment buildings along the eastern side of the ROW. Potential construction noise and vibration impacts could affect these industrial uses. Potential operation vibration impacts could affect these industrial uses.</p> <p>Between Sycamore St. and Wilhelmina St. there is one long industrial building that abuts the ROW along the western side of the ROW and twelve apartment buildings along the eastern side of the ROW. Potential construction noise and vibration impacts could affect these industrial uses. Potential operation vibration impacts could affect these industrial uses.</p> <p>Between Wilhelmina St. and North St. there is an RV storage facility along the western side of the ROW and eleven apartment buildings along the eastern side of the ROW. Potential construction noise and vibration impacts could affect these industrial uses. Potential operation vibration impacts could affect these industrial uses.</p>	<p>Between South St. and Santa Ana St. there are two industrial buildings along the western side of the ROW and one industrial building along the eastern side of the ROW. Potential construction and operation vibration impacts could affect these industrial uses.</p> <p>Between Santa Ana St. and Broadway there are three industrial buildings along the western side of the ROW and six apartment buildings along the eastern side of the ROW. Potential construction and operation vibration impacts could affect these industrial and residential uses.</p> <p>Between Broadway and Lincoln Ave. there is a mini park (Citrus Park) and associated parking lot, and the Y Children's Station (located in the former UP Railroad Station building) along the western side of the ROW and one apartment building and eleven SF houses along the eastern side of the ROW. The Y Children's Station building would be a total take. Potential construction and operation noise and vibration impacts could affect the park and residential uses.</p> <p>Between Lincoln Ave. and Cypress St. there are four single family (SF) houses along the western side of the ROW and a landscaped open space area along the eastern side of the ROW. Potential construction and operation noise and vibration impacts could affect the landscaped open space area and residential uses.</p> <p>Between Cypress St. and Sycamore St. there are three industrial use along the western side of the ROW and twelve apartment buildings along the eastern side of the ROW. Potential construction and operation noise and vibration impacts could affect these industrial and residential uses.</p> <p>Between Sycamore St. and Wilhelmina St. there is one long industrial building that abuts the ROW along the western side of the ROW and twelve apartment buildings along the eastern side of the ROW. Potential construction and operation noise and vibration impacts could affect these industrial and residential uses.</p> <p>Between Wilhelmina St. and North St. there is an RV storage facility along the western side of the ROW and eleven apartment buildings along the eastern side of the ROW. Potential construction and operation noise and vibration impacts could affect these commercial and residential uses.</p>
Visual / Scenic Resources	<p>Starting in the south between Vermont Ave. and South St. there are three industrial buildings along the western side of the ROW and five industrial buildings along the eastern side of the ROW. Potential construction and operational aesthetic and visual impacts would not affect these industrial uses.</p> <p>Between South St. and Santa Ana St. there are two industrial buildings along the western side of the ROW and one industrial building along the eastern side of the ROW. Potential construction and operational aesthetic and visual impacts would not affect these industrial uses.</p> <p>Between Santa Ana St. and Broadway there are three industrial buildings along the western side of the ROW and six apartment buildings along the eastern side of the ROW. Potential construction and operational aesthetic</p>	<p>Visual and scenic resources would not be impacted during construction or operation of a deep bore tunnel within the 50' ROW.</p>

Evaluation Measure	Cut-and-Cover Tunnel	Deep Bore Tunnel
	<p>and visual impacts would not affect the industrial uses, but there would be an impact to the residential uses during construction.</p> <p>Between Broadway and Lincoln Ave. there is a mini park (Citrus Park) and associated parking lot, and the Y Children's Station (located in the former UP Railroad Station building) along the western side of the ROW and one apartment building and eleven SF houses along the eastern side of the ROW. The Y Children's Station building would be a total take. Potential construction and operational aesthetic and visual impacts would affect both the park uses and the residential uses.</p> <p>Between Lincoln Ave. and Cypress St. there are four single family (SF) houses along the western side of the ROW and a landscaped open space area along the eastern side of the ROW. Potential construction and operational aesthetic and visual impacts would affect both the residential uses and the landscaped open space area.</p> <p>Between Cypress St. and Sycamore St. there are three industrial uses along the western side of the ROW and twelve apartment buildings along the eastern side of the ROW. Potential construction and operational aesthetic and visual impacts would not affect the industrial uses but the residential uses would be affected during construction.</p> <p>Between Sycamore St. and Wilhelmina St. there is one long industrial building that abuts the ROW along the western side of the ROW and twelve apartment buildings along the eastern side of the ROW. Potential construction and operational aesthetic and visual impacts would not affect the industrial use but the residential uses would be affected during construction.</p> <p>Between Wilhelmina St. and North St. there is an RV storage facility along the western side of the ROW and eleven apartment buildings along the eastern side of the ROW. Potential construction and operational aesthetic and visual impacts would not affect the RV storage facility but the residential uses would be affected during construction.</p>	
Geologic / Soil Constraints	There are no known geologic or soils constraints within the 50' ROW area.	
Hazardous Materials	<p>Starting in the south between Vermont Ave. and South St. there are three industrial buildings along the western side of the ROW and five industrial buildings along the eastern side of the ROW. Potential hazardous materials and waste impacts could be associated with these industrial uses.</p> <p>Between South St. and Santa Ana St. there are two industrial buildings along the western side of the ROW and one industrial building along the eastern side of the ROW. Potential hazardous materials and waste impacts could be associated with these industrial uses.</p> <p>Between Santa Ana St. and Broadway there are three industrial buildings along the western side of the ROW and six apartment buildings along the eastern side of the ROW. Potential hazardous materials and waste impacts could be associated with these industrial uses, but there would not be an impact associated with the residential uses.</p> <p>Between Broadway and Lincoln Ave. there is a mini park</p>	There is a potential that underground contamination from the industrial uses along the 50' ROW could impact construction of a deep bore tunnel.

Evaluation Measure	Cut-and-Cover Tunnel	Deep Bore Tunnel
	<p>(Citrus Park) and associated parking lot, and the Y Children's Station (located in the former UP Railroad Station building) along the western side of the ROW and one apartment building and eleven SF houses along the eastern side of the ROW. The Y Children's Station building would be a total take. Potential hazardous materials and waste impacts would not be associated with the park uses and the residential uses.</p> <p>Between Lincoln Ave. and Cypress St. there are four single family (SF) houses along the western side of the ROW and a landscaped open space area along the eastern side of the ROW. Potential hazardous materials and waste impacts would not be associated with the residential uses and the landscaped open space area.</p> <p>Between Cypress St. and Sycamore St. there are three industrial uses along the western side of the ROW and twelve apartment buildings along the eastern side of the ROW. Potential hazardous materials and waste impacts could be associated with the industrial uses but not with the residential uses.</p> <p>Between Sycamore St. and Wilhelmina St. there is one long industrial building that abuts the ROW along the western side of the ROW and twelve apartment buildings along the eastern side of the ROW. Potential hazardous materials and waste impacts could be associated with the industrial uses but not with the residential uses.</p> <p>Between Wilhelmina St. and North St. there is an RV storage facility along the western side of the ROW and eleven apartment buildings along the eastern side of the ROW. Potential hazardous materials and waste impacts could be associated with the RV storage facility but not with the residential uses.</p>	

4.3.7 Conclusions

4.3.7.1 At-Grade

The At-Grade Option will have the most ROW impacts of any option through Anaheim. However, the option has the fewest constructability issues because the land acquired for the additional tracks allows more room to stage construction along the corridor. In addition, it provides grade separations for all railroad operators in the corridor, a potential benefit to the surrounding community in reducing train horn noise and traffic congestion, unlike the non at-grade options. The grade separations will be further studied during the preliminary design and will be carried forward for full environmental analysis.

4.3.7.2 Aerial

The aerial option can be built at the lowest cost of any of the four options, but has impacts in several areas. There is potential for visual impacts from the aerial guideway to residential communities (including the Anaheim Colony Historical District), which will require mitigation. The more significant issue is constructability. To build a two track aerial structure in the middle of a busy and constrained two-track railroad is extremely difficult and disruptive to the approximately 100 passenger trains that would be using the corridor per day during the construction period. The additional ROW that would be needed to mitigate operational impacts during construction would be similar to the ROW needs of the At-Grade option, so the alternative does not reduce or avoid the adverse environmental impacts of the at-grade option.

Constructing the aerial option within the existing ROW is impractical due to the potential adverse disruptions to existing and future railroad operations. To be able to construct the HST Project without

these operational impacts, large areas of additional ROW would be needed. These ROW takes would be similar to the at-grade option, so alternative construction methods needed to allow for adequate railroad operations during construction of the aerial option would not eliminate or reduce the adverse ROW impacts of the at-grade option. The aerial option does not eliminate or reduce the ROW impacts of the at-grade option, and configurations that do reduce the at-grade ROW impacts are not constructible, therefore the aerial option should be eliminated from further consideration.

4.3.7.3 Cut-and-Cover Tunnel

The shallow tunnel option has few operational environmental impacts. As with the aerial option, the significant impacts occur during construction. Constructing a two track tunnel structure underneath a busy and constrained two-track railroad is extremely difficult and disruptive to the approximately 100 passenger trains using the corridor per day during the construction period. In addition, the existing undercrossing at Lincoln Avenue is directly in the path of the cut-and-cover tunnel, necessitating an expensive reconfiguration of the crossing that will have significant traffic and ROW impacts. To ease construction, major ROW takes would be needed, but these would require nearly as much ROW as the at-grade options at a much higher cost.

Constructing the cut-and-cover tunnel option within the existing ROW is impractical due to the potential adverse disruptions to existing and future railroad operations. To be able to construct the cut-and-cover tunnel option without these operational impacts, large areas of additional ROW would be needed. These ROW takes would be similar to the at-grade option, so alternative construction methods needed to allow for adequate railroad operations during construction of the cut-and-cover tunnel option would not eliminate or reduce the adverse ROW impacts of the at-grade option. Given that the cut-and-cover tunnel option does not eliminate or reduce the ROW impacts of the at-grade option, and configurations that do reduce the at-grade ROW impacts are not constructible, the cut-and-cover tunnel option should be eliminated from further consideration.

4.3.7.4 Deep Bore Tunnel

The deep tunnel option is the most expensive option and will require ROW takes and construction impacts at the portal areas, but otherwise would avoid potential visual impacts of either the at-grade or aerial options. Staging areas for the tunnel boring machines are planned for the La Palma Avenue area in the north and the Vermont Avenue area in the south, at either end of the 50' wide ROW. These areas will require additional ROW width for staging, shoofty tracks (approximately 2,000 feet long at each portal), and the removal of spoil from the tunnel boring operation, with each staging area requiring approximately 5 acres of additional ROW. The typical tunnel section will likely be slightly outside the existing ROW lines. Underground easements are needed for the outer portions of the tunnel sections. While the tunneling process is difficult and costly, it is feasible and should not differ greatly from the many bored tunnels that have recently been completed across the country. Further investigations should be made into the cost of a deep bore tunnel and staging of the tunnel construction. Because of the limited 50' ROW through Anaheim, the deep bore tunnel option should be carried forward for further analysis.

4.3.8 Options Eliminated / Carried Forward

Options to be eliminated from further consideration:

- **Aerial**
- **Cut-and-Cover Tunnel**

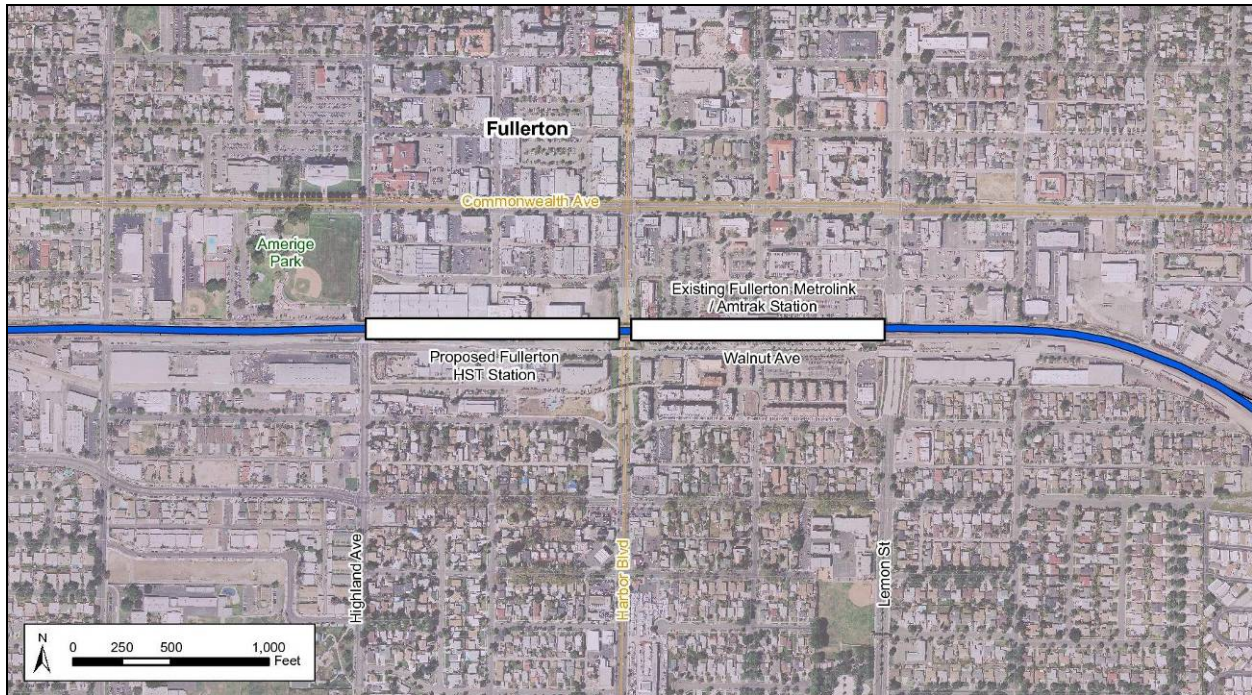
Options to be carried forward:

- **At-Grade**
- **Deep Bore Tunnel**

4.4 FULLERTON STATION

The existing Fullerton Transportation Center is the busiest rail station in Orange County and serves the Metrolink Orange County and 91 Lines as well as the Amtrak Pacific Surfliner and Southwest Chief routes. Three tracks currently pass through the station, with side platforms on the north and south sides of the tracks. As part of the OCTA 30-Minute Metrolink Service Expansion program, a fourth track will be built on the south side of the existing south platform to allow for additional trains to operate between Fullerton and Laguna Niguel. Additional expansion at-grade beyond the planned four-track footprint will be difficult, with city streets, new transit-oriented development, and historic structures all located in close proximity to the tracks. An overview of the station area is given in Figure 4.9.

Figure 4.9. Fullerton Station Area – Overview



Source: AE LLC, STV Incorporated

The preferred alternative from the program-level environmental analysis did not include an HST station at Fullerton. Comments received during the scoping process for the Project EIR/EIS in favor of a Fullerton HST station have led to a reexamination of the inclusion of a station at Fullerton. A Fullerton Station option will be examined as part of the project-level environmental process.

There are three options that are explored in the Fullerton Station area: at-grade without an HST station, aerial with an HST station, and a deep tunnel HST station.

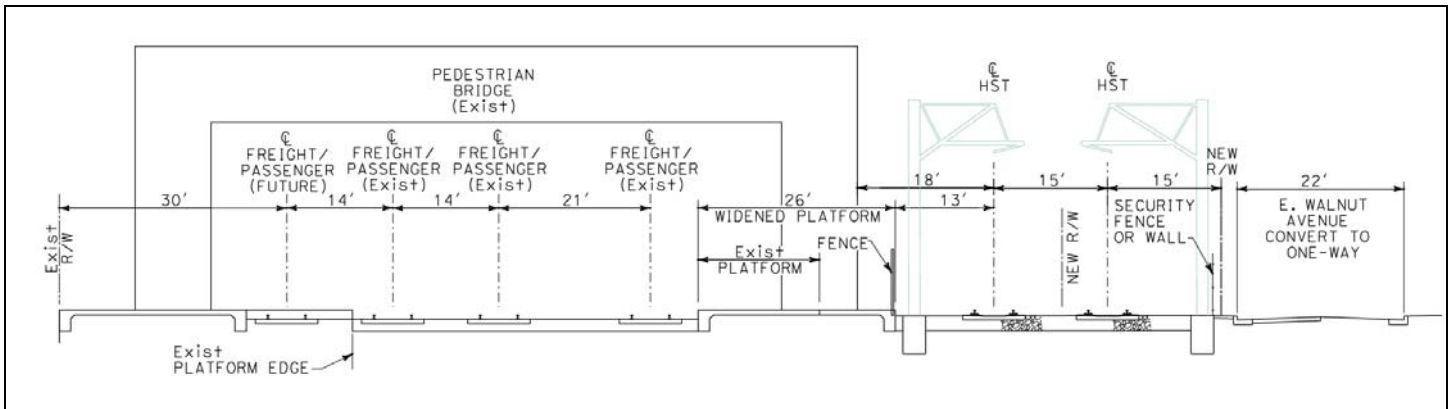
4.4.1 No Fullerton HST Station – At-Grade

If an HST station is not constructed in Fullerton, the two HST tracks will need to bypass the existing Metrolink / Amtrak station. This can be done at-grade on the south side of the station, where the existing parking area is located and the fourth track for the Fullerton Turnback Facility is planned. A future fourth main track for the other operators in the corridor can be added to the north of the existing tracks, where space is already reserved on the railroad bridges over Lemon Street and Harbor Boulevard. A cross-section for this option is shown in Figure 4.10. Plans and profiles for this option are shown on Sheet 70 in Appendix E.

4.4.2 Fullerton HST Station – Aerial

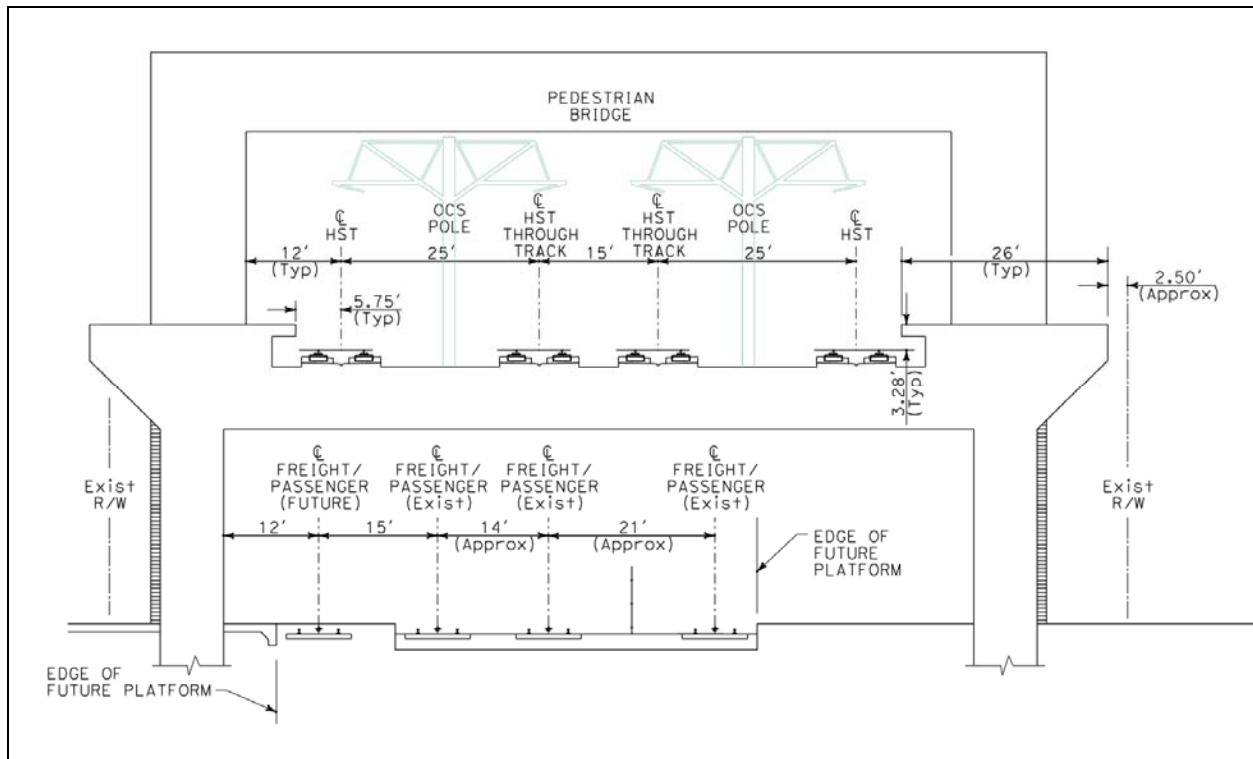
If a HST station is included at Fullerton, it will require four HST tracks to allow for passing of stopping trains. The ROW is very constrained in the area, with streets close to the track on either side and new transit oriented development around the station. An at-grade station would require approximately 75 feet of additional ROW width to the south of the existing station in a residential area, and has not been investigated due to its significant impacts to the surrounding community. An aerial configuration for the HST tracks has been designed to minimize impacts to the surrounding community, with the HST tracks and platforms located above the existing station on a straddle bent structure, as shown in Figure 4.11. Plan and profile drawings for this option are shown on Sheets 100-105 in Appendix E.

Figure 4.10. Typical Cross-Section – Fullerton without HST Station – At-Grade



Source: STV Incorporated

Figure 4.11. Typical Cross-Section – Fullerton HST Station – Aerial



Source: STV Incorporated

4.4.3 Fullerton HST Station – Deep Tunnel

Another option examined is to bore a tunnel and build a subterranean station at Fullerton. The tunnel portal on the north end would be located just west of the Fullerton Airport. The proposed tunnel would then run directly underneath the existing ROW at roughly 50 to 70' deep. A subterranean station area would be excavated under the existing Fullerton Transportation Center. The tunnel would continue underground, directly under the existing ROW, and the south end would return to at-grade around the Orangethorpe Avenue. If the deep tunnel option is selected through Anaheim, it is likely that it would be connected to the Fullerton Deep Tunnel station using a single bore to simplify construction staging.

4.4.4 Evaluation Table – Fullerton Station Options

Evaluation Measure	No Fullerton HST Station – At-Grade Option	Fullerton HST Station – Aerial Option	Fullerton HST Station – Deep Tunnel Option
Ridership / Revenue Potential	No riders can access HST system at Fullerton. Access would be provided in Anaheim, 5 miles to the south.	Fullerton HST station serves northern Orange County, southern Los Angeles County, western Riverside and San Bernardino counties.	
Intermodal Connections	No access to HST from other modes at Fullerton.	Fullerton Transportation Center allows for transfers between HST, Metrolink, Amtrak, and buses.	
Capital Costs	At-grade construction without HST station minimizes costs in area.	Elevated HST station is more expensive to build than at-grade, no-station option.	Deep tunnel HST station is more expensive to build than at-grade and aerial options due to very expensive tunneling activities (both tunnel boring machines and large cavern for station area). Approximately three times more expensive than aerial station option.
Operating Costs	At-grade construction without HST station minimizes costs in area.	Aerial alignment with HST station is more expensive to operate than at-grade, no-station option.	Deep tunnel HST station is more expensive to operate than at-grade and aerial options due to ventilation, lighting, emergency access / egress, monitoring of operations, and other operating activities.
Operations Issues	Potential staging issues with Fullerton Turnback Facility.	HST stations at Anaheim and Fullerton would be very close, limit HST speeds through area. The existing sharp curve just east of Fullerton station would remain, limiting operational speeds through this area to 60 mph.	
Station Area Development Potential	Fullerton is already site of major TOD activity, but new development would lack direct access to HST.	HST station would enhance existing TOD plans in area.	
Consistency with Other Planning Efforts	Enhanced Transportation Center is consistent with the City of Fullerton's Framework Plan, which identifies infrastructure improvements needed to support future redevelopment goals.	HST service is consistent with the City of Fullerton's Framework Plan, which identifies infrastructure improvements needed to support future redevelopment goals.	
Constructability	Will introduce temporary impacts to south side of station during construction, and modifications to Fullerton Turnback Facility.	Difficult to construct new HST station above existing station without significant impacts to operations.	Staging areas for the tunnel boring machines are located near Orangethorpe Avenue in south and in the industrial area to the west of the Fullerton Airport. These areas will require additional ROW width for staging, shoofly tracks (approximately 2,000 feet long at each portal), and removal of spoil from the tunnel boring operation. The excavated station will cover an approximate area of 2600 feet by 100 feet directly under the existing Fullerton Transportation Center, requiring extensive and complex structural support for the above ground buildings and transportation structures.

Evaluation Measure	No Fullerton HST Station – At-Grade Option	Fullerton HST Station – Aerial Option	Fullerton HST Station – Deep Tunnel Option
Displacements / Property Access Impacts	Majority of station can be accommodated between existing tracks and Walnut Street in existing parking areas. No displacement or property access impacts would occur.	Can generally be constructed above existing tracks within existing ROW.	Each staging area will require approximately 5 acres of additional ROW. Underground easements will be needed for the outer portions of the of the tunnel sections.
Station Area Traffic Impacts	There is little potential for additional traffic impacts from the addition of HST tracks.	Would introduce large numbers of new riders to Fullerton station area.	
Waterways / Sensitive Habitat Areas	There are no waterways or sensitive habitat areas within the Fullerton Station area. No impacts to these resources would occur.		
Cultural Resources	Potential exists for the addition of HST tracks to impact cultural resources within the historic depot station area.	The addition of a new aerial structure and station within close proximity to the historic depot building could result in potential impacts to cultural resources, visual/aesthetic resources, and noise/vibration.	Potential exists to impact cultural resources within the historic depot station area during construction.
Parklands	No parklands are located in the immediate area of the Fullerton Station.		
Agricultural Lands	There are no agricultural lands in the Fullerton Station area.		
Noise / Vibration	<p>There is a potential for construction and operational noise and vibration impacts to adjacent commercial, residential, and historic buildings.</p> <p>Passby noise levels of an at-grade high-speed train operating at 125 mph would generate 3 dB less noise than an at-grade diesel operated Amtrak or Metrolink train at 80 mph.</p>	<p>There is a potential for construction and operational noise and vibration impacts to adjacent commercial, residential, and historic buildings.</p> <p>A high-speed train operating at 125 mph on aerial structure would generate the same wayside noise level as an at-grade diesel operated Amtrak or Metrolink train at 80 mph.</p>	There is a potential for construction noise and vibration impacts to adjacent commercial, residential, and historic buildings.
Visual / Scenic Resources	Installing HST tracks through the Fullerton Station area would alter the appearance of the existing station.	An aerial station would have a potential impact on the visual / scenic resources in adjoining residential and historic station areas by blocking views and creating shadows. The HST Station itself would be designed to fit into the architectural theme in the Fullerton Station area.	Visual and scenic resources would not be impacted during construction or operation of a deep tunnel station.
Geologic / Soil Constraints	There are no known geologic or soils constraints within the Fullerton Station area.	Due to the deeper subsurface disturbances for aerial foundations there is a potential that geologic or soil constraints could be encountered.	Due to the deeper subsurface disturbances for deep tunnel station and alignment, there is a potential that geologic or soil constraints could be encountered.
Hazardous Materials	Due to the shallow subsurface disturbance needed for construction, no impacts from hazardous materials would occur due to the addition of HST tracks through the Fullerton Station area.	Due to the deeper subsurface disturbances for aerial foundations there is a potential that underground contamination from the industrial uses within the Fullerton Station area could occur.	Due to the deeper subsurface disturbances for deep tunnel station and alignment, there is a potential that underground contamination from the industrial uses within the Fullerton Station area could occur.

4.4.5 Conclusions

The at-grade, no HST station option has lower costs and environmental impacts than the HST station option, but does not provide for HST service at Fullerton, currently the busiest rail station in Orange County. The aerial HST option does provide service at Fullerton, but has the potential for more impacts to the surrounding community than the no HST station option, such as visual impacts. The HST guideway structure would have a potential to impact visual and scenic resources in the area by blocking sightlines and creating shadows. Supporting station facilities (new waiting / ticketing areas, parking, and others) would have identical visual impacts for the Aerial and Deep Tunnel station options.

The Deep Tunnel HST Station option has similar ROW impacts compared to the Aerial HST Station option. The largest differences are in the constructability, cost, and visual impact of the option.

Constructing the deep tunnel station will be a difficult, disruptive, and costly operation (approximately three times more expensive than the aerial option). A large cavern will need to be dug out directly underneath the existing station to allow for four HST tracks and two HST platforms. Shafts would be dropped to the tunnel (which will be underneath the existing Harbor Blvd and Lemon St underpasses), and large amounts of spoil will need to be removed through neighborhoods in the area. In addition, two more staging areas for tunnel boring machines will be needed away from the station (in the vicinity of Orangethorpe Avenue and Fullerton Airport), with substantial ROW takes needed for shoo-fly tracks and staging equipment. As mentioned above, supporting station facilities such as parking structures will be identical to the aerial option's facilities. After construction, the deep tunnel station will not have any visual impact, as it will not include the above ground guideway structures of the aerial option which have the potential to block views and cast shadows.

The difficulty and cost of constructing the deep tunnel station option will result in avoidance of the visual and shadow impacts of an aerial structure. Given the impracticability of constructing a Deep Tunnel HST station at Fullerton without significant impacts and disruptions to the surrounding community, and little or no significant environmental benefits of the less expensive aerial HST option, the deep tunnel HST station option at Fullerton should be eliminated from further consideration.

The at-grade and aerial options should be carried forward, and a more detailed analysis of the relative merits of the Fullerton and Norwalk / Santa Fe Springs HST station options should be carried out in the Project EIR/EIS.

4.4.6 Options to be Eliminated / Carried Forward

Options to be eliminated from further consideration:

- **Fullerton HST Station – Deep Tunnel**

Options to be carried forward:

- **No Fullerton HST Station – At-Grade**
- **Fullerton HST Station – Aerial**

4.5 FULLERTON AIRPORT

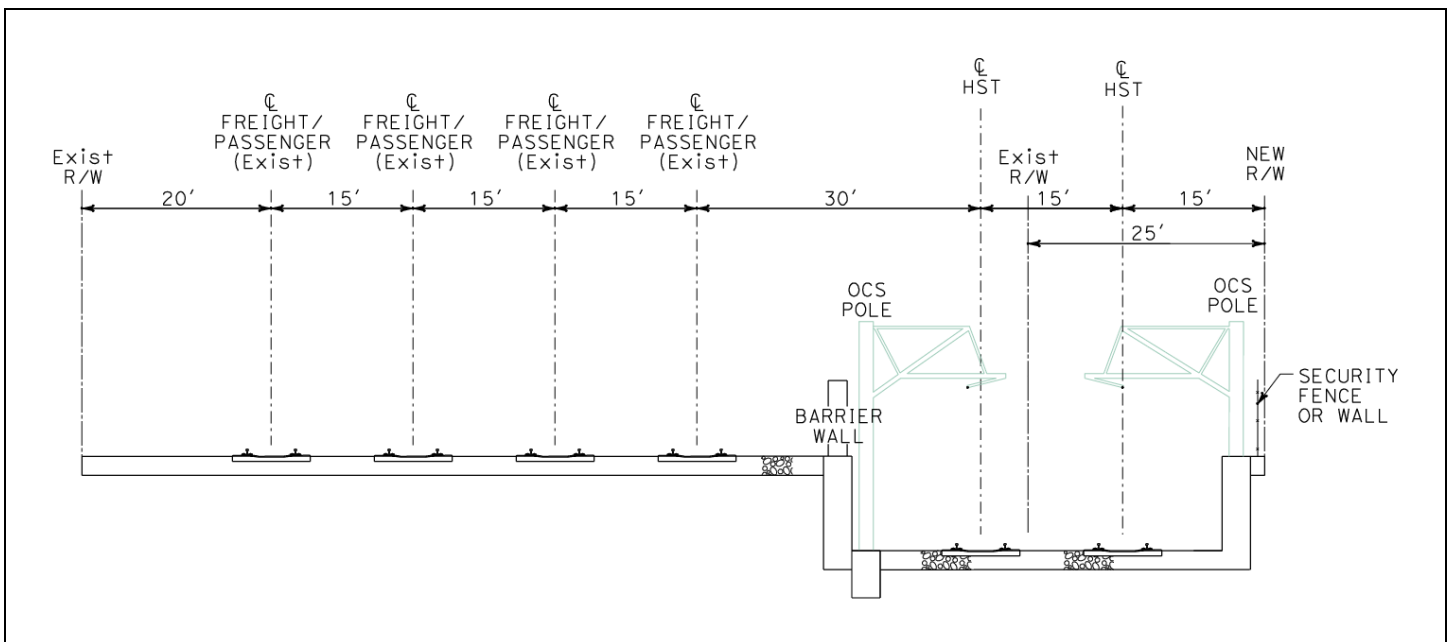
West of Gilbert Street in Fullerton and Buena Park, the HST alignment will need to enter a trench to pass under the Fullerton Airport runway, which lies directly to the west of the LOSSAN corridor. Based on the height of the Catenary System for HST, tracks through the area will need to be trenched to comply with FAA requirements. An overview of the Fullerton Airport area is shown in Figure 4.12. A typical cross section through this area is shown in Figure 4.13. Plan and profile drawings for this subsection are shown on Sheets 63 and 64 in Appendix E.

Figure 4.12. Fullerton Airport - Overview



Source: AE LLC, STV Incorporated

Figure 4.13. Fullerton Airport – Typical Section



Source: STV Incorporated

4.6 BUENA PARK METROLINK STATION

The newest Metrolink Station in Orange County is located in Buena Park just west of Dale Street. This station includes an at-grade parking lot to the north of two station platforms, three main tracks through the station, and a pedestrian bridge over the tracks. The platforms and pedestrian crossing can be modified to accommodate four tracks through the station in the future. New housing developments to the north

and south of the station are built very close to the ROW, making any future at-grade expansion of the station difficult. An overview of the station area is shown in Figure 4.14.

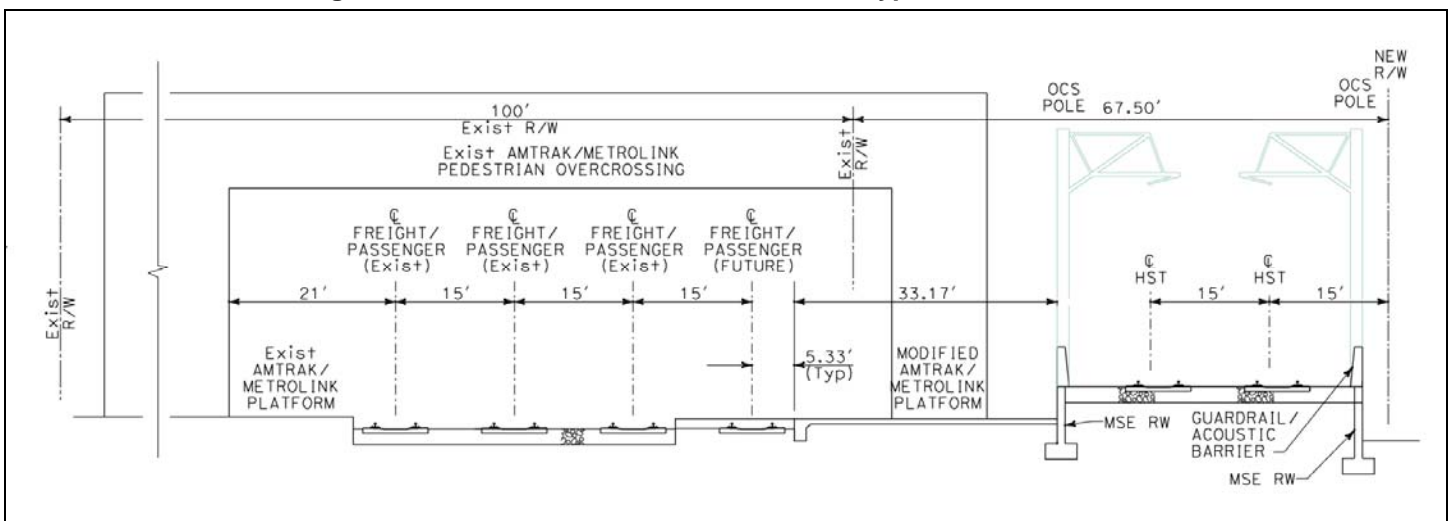
The HST alignment will pass to the south of the existing station and platforms at-grade, requiring ROW takes of approximately 45' of width of residential properties to the south. A typical cross-section through this area is shown in Figure 4.15. Plan and profile drawings for this area are shown on Sheets 62 and 63 in Appendix A.

Figure 4.14. Buena Park Metrolink Station – Overview



Source: AE LLC, STV Incorporated

Figure 4.15. Buena Park Metrolink Station – Typical Cross-Section

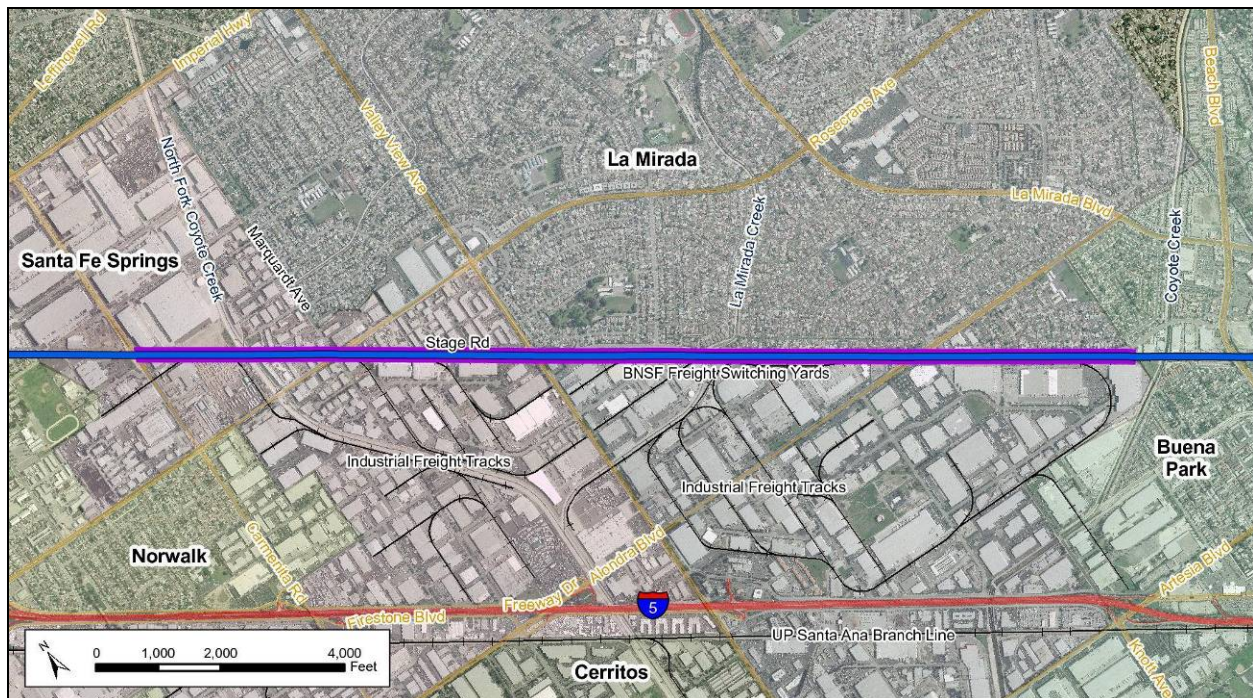


Source: STV Incorporated

4.7 LA MIRADA RAIL YARDS

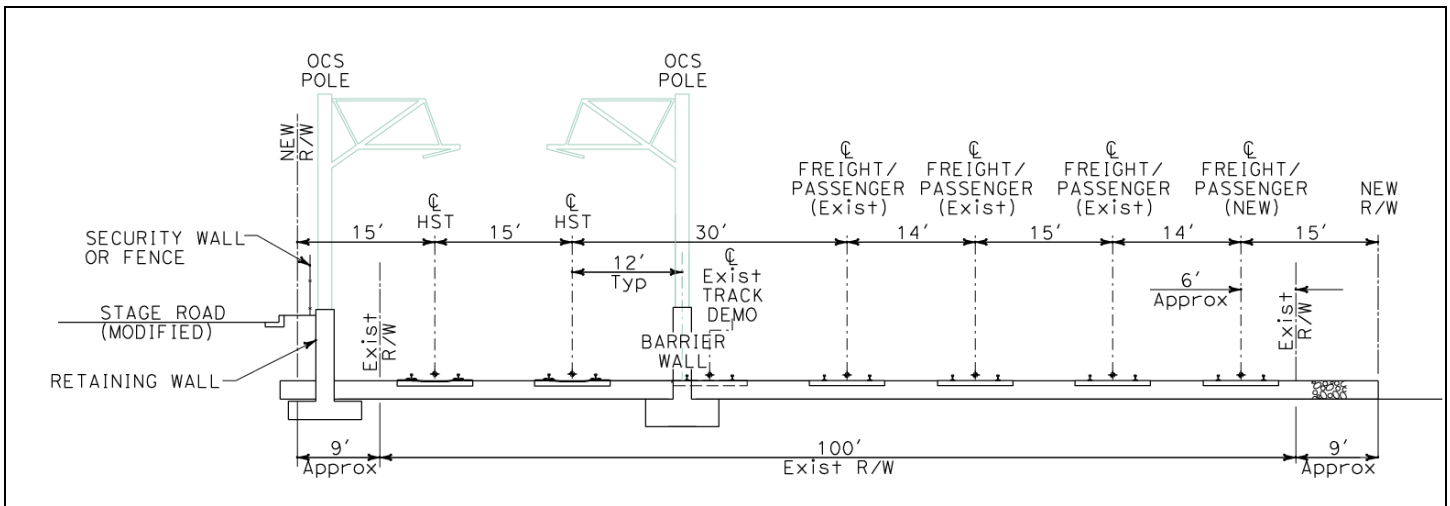
There are a large number of freight rail spurs, industrial tracks and yards through La Mirada and Santa Fe Springs that receive interstate freight delivered by the BNSF (from approximately the Orange County Line to Carmenita Road). Access to these tracks cannot be cut off, so a typical configuration of two at-grade passenger rail tracks to the south of three freight tracks is not feasible. If the HST tracks are continued on the south side of the corridor, an approximately four mile long aerial structure would be required to avoid freight conflicts. Instead, flyovers at either end of this subsection will carry the HST tracks to the north side of the corridor, where they no longer conflict with freight movements. The flyovers are located just west of the Buena Park Metrolink Station and just south of the Norwalk / Santa Fe Springs Station. An overview of the La Mirada Rail Yards area is shown in Figure 4.16. A typical cross-section is shown in Figure 4.17. Plan and profile drawings for this area are shown on Sheets 50-62 in Appendix E.

Figure 4.16. La Mirada Rail Yards – Overview



Source: AE LLC, STV Incorporated

Figure 4.17. La Mirada Rail Yards – Typical Section



Source: STV Incorporated

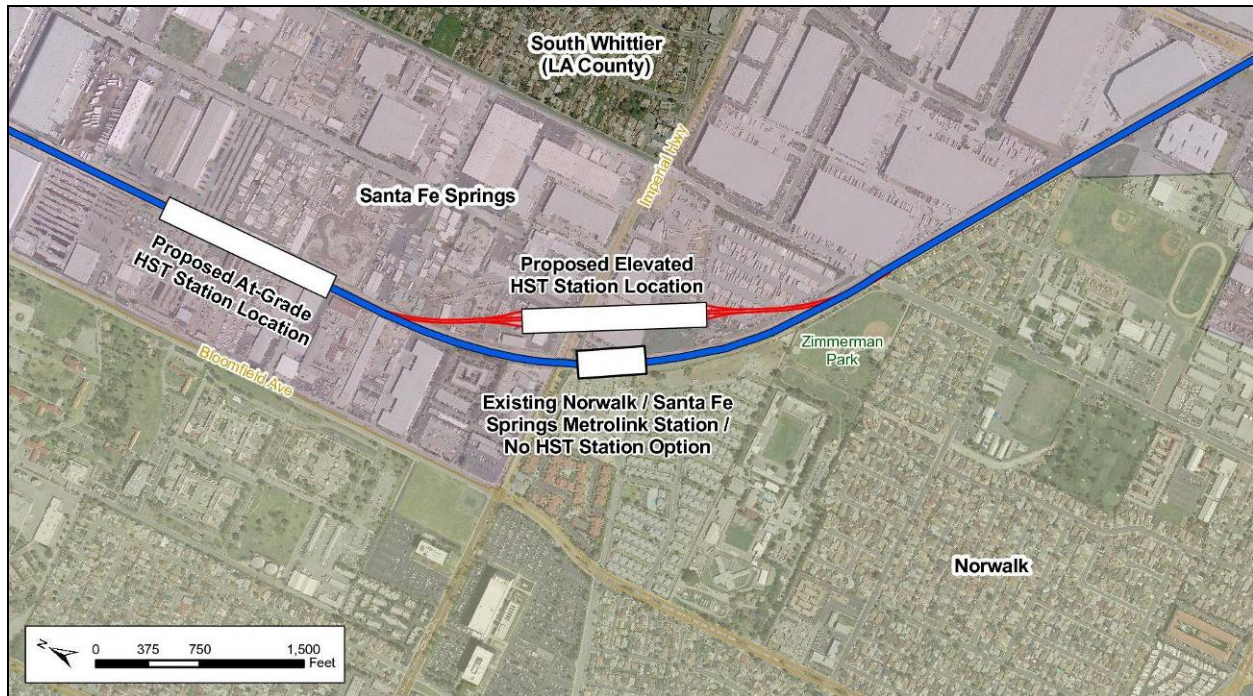
4.8 NORWALK / SANTA FE SPRINGS STATION

The current Norwalk / Santa Fe Springs Metrolink Station lies on a curve in the LOSSAN corridor just south of Imperial Highway on the jurisdictional boundary between the cities of Norwalk and Santa Fe Springs. Four tracks run through the station, with a pedestrian aerial structure connecting two side platforms. The westernmost Metrolink track is aligned slightly differently than the other three tracks to allow for a straight southbound station platform.

The preferred alternative from the program-level environmental analysis included a HST station at Norwalk / Santa Fe Springs. With a Fullerton Station Option now included for this section as well, it is likely only one station will be built. The benefits and impacts of HST stations at Norwalk / Santa Fe Springs and Fullerton will need to be thoroughly examined.

There are three basic designs that are currently being examined for the Norwalk / Santa Fe Springs Station. They are described in the following subsections and shown in Figure 4.18.

Figure 4.18. Norwalk / Santa Fe Springs Station Area – Overview



Source: AE LLC, STV Incorporated

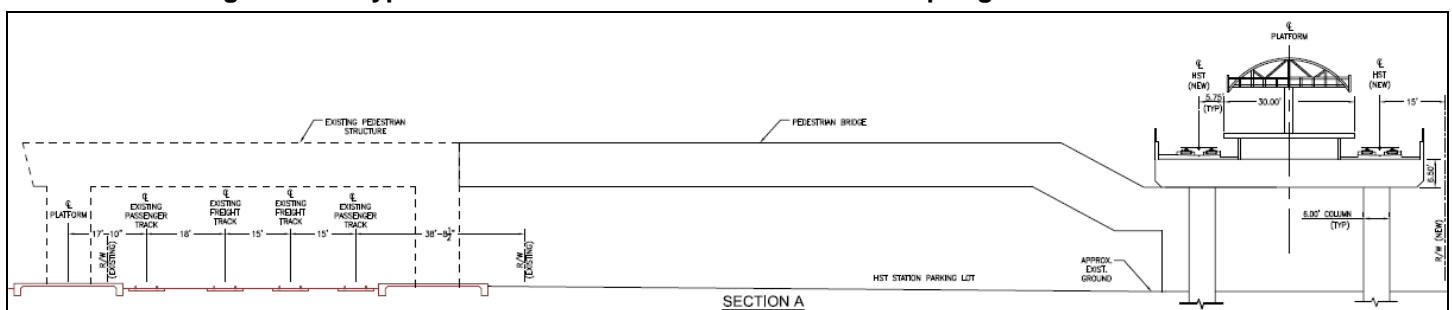
4.8.1 No HST Station

If there is not a HST station at Norwalk / Santa Fe Springs, the HST tracks would continue to follow the existing LOSSAN corridor through the curve and Metrolink station area. The two new HST tracks would run on an aerial structure to the east of the existing tracks and platform (allowing for higher operating speeds), transitioning to the west side of the corridor north of the station for the remainder of the route to Los Angeles. Plan and profile drawings for this option are shown on Sheets 50-53.

4.8.2 HST Station east of Existing Metrolink Station

To simplify intermodal connections, the best location for the new HST station is as close to the existing station as possible. The existing Metrolink station is on a curve, though, and HST stations must be built on a tangent section of track. This requires the new HST station to be built to the east of the existing station of the inside of the curve as shown in Figure 4.18. A typical cross-section for this option is shown in Figure 4.19. The station is shown as an aerial configuration, but an at-grade or retained fill configuration could also be possible.

Figure 4.19. Typical Cross-Section – Norwalk / Santa Fe Springs – East HST Station

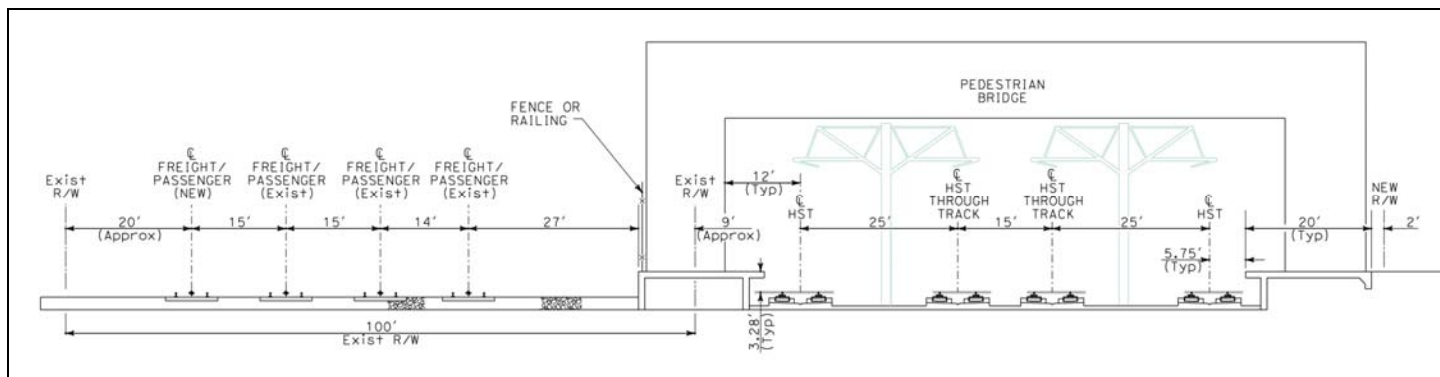


Source: STV Incorporated

4.8.3 HST Station north of Existing Metrolink Station

The other option for locating the HST station is north of the existing station. This avoids the constraints presented by the existing curve, but requires additional ROW and longer station connections. A typical cross-section for this configuration is shown in Figure 4.20.

Figure 4.20. Typical Cross-Section – Norwalk / Santa Fe Springs – North HST Station



Source: STV Incorporated

4.8.4 Evaluation Table – Norwalk / Santa Fe Springs Station Options

Evaluation Measure	No HST Station	HST Station east of Existing Metrolink Station	HST Station north of Existing Metrolink Station
Ridership / Revenue Potential	No riders can access HST system at Norwalk / Santa Fe Springs.	Norwalk / Santa Fe Springs HST station serves northern Orange County, southern Los Angeles County, western Riverside and San Bernardino counties.	
Intermodal Connections	No access to HST from other modes at station.	Allows for transfers to Metrolink and buses via pedestrian walkway. Potential connection to LAX.	Does not allow for easy connections to Metrolink trains at existing station, approximately ½ mile to south. But, connections to Metrolink at this station are expected to be minimal given the lack of Metrolink stations between Norwalk / Santa Fe Springs and LAUS (Commerce station is only served by limited number of trains). Most transfers between Metrolink and HST system in Los Angeles County expected to take place at LAUS. Potential connection to LAX.
Capital Costs	Addition of new tracks to east of existing tracks. Minor ROW displacements.	Capital costs include the cost of an aerial structure with straight station platforms, property takes and station expenses (generally minimal), as existing station facilities would be available for HST use.	Capital costs include the cost of a new at-grade station and property takes.
Operating Costs	At-grade construction without HST station minimizes costs in area.	HST station is more expensive to operate than at-grade, no-station option.	
Operations Issues	No major operations issues foreseen.	Curves entering station will lower operating speeds to approximately 50 mph (existing curve is approximately 80 mph). This will impose operating constraints for non-stopping high-speed trains (not all trains will stop at Norwalk / Santa Fe Springs) that will be contrary to project's purpose and objectives.	No major operations issues foreseen.
Station Area Development Potential	Neither Norwalk nor Santa Fe Springs have expressed interest in major station area development. HST station options would provide better opportunities than no station.		

Evaluation Measure	No HST Station	HST Station east of Existing Metrolink Station	HST Station north of Existing Metrolink Station
Consistency with Other Planning Efforts	No major planning efforts underway in station area.		
Constructability	No major constructability issues foreseen other than need to preserve existing station and railroad operations during construction.		
Displacements / Property Access Impacts	Minor ROW takes to east of existing tracks through station area would be required.	Acquisition of large parcels of industrial properties both south and north of Imperial Highway would be needed. It would take at least eight industrial buildings and a large number of parking spaces and trailer storage areas.	Locating a HST Station to the north of the existing Norwalk / Santa Fe Springs Station would require the acquisition of large parcels of industrial properties on the west side of the LOSSAN corridor. It would take at least two industrial buildings and a large number of parking spaces and storage areas.
Station Area Traffic Impacts	Potential for minor traffic impacts during construction of the HST tracks. No traffic impacts during the operation of the HST service.	Construction and operation of a HST station would introduce large numbers of new traffic trips to the Norwalk / Santa Fe Springs station area.	
Waterways / Sensitive Habitat Areas	There are no waterways or sensitive habitat areas within the Norwalk / Santa Fe Springs Station area. No impacts to these resources would occur.		
Cultural Resources	There are no known cultural resources within the Norwalk / Santa Fe Springs Station area that would be affected.		
Parklands	Zimmerman Park is located south of existing station on the west side of the LOSSAN corridor. Zimmerman Park is specifically designed for baseball / softball games; there are no other recreational facilities on the park site. Construction and operation of a HST Station either to the east or north of the existing station would have potential to impact the use of the park.		
Agricultural Lands	There are no agricultural lands in the Norwalk / Santa Fe Springs Station area.		
Noise / Vibration	No impacts are expected.	There are multi-family (MF) residential uses located on the west side of the LOSSAN corridor south of Civic Center Dr. Construction and operation of an elevated HST Station east of the existing Norwalk / Santa Fe Springs Station would have the potential to cause noise impacts at these MF residential uses.	There are no residential uses adjacent to where the HST Station would be located to the north of the Norwalk / Santa Fe Springs Station. No noise or vibration impacts would occur.
Visual / Scenic Resources	No impacts are expected.	There are multi-family (MF) residential uses located on the west side of the LOSSAN corridor south of Civic Center Dr. Construction and operation of an elevated HST Station east of the existing Norwalk / Santa Fe Springs Station would have the potential to cause visual / scenic impacts at these MF residential uses.	Locating an at-grade HST station to the north of the existing Norwalk / Santa Fe Springs Station would not impact visual / scenic resources because the station area is surrounded by industrial uses.
Geologic / Soil Constraints	There are no known geologic or soils constraints within the Norwalk / Santa Fe Springs Station area.		
Hazardous Materials	There is a potential that underground contamination from the industrial uses within the Norwalk / Santa Fe Springs Station area could impact construction of aerial or at-grade HST stations and tracks.		

4.8.5 Conclusions

The at-grade, no HST station option would improve overall travel time between Anaheim and LA, has lower costs and fewer environmental impacts than either of the station options, but does not provide for HST service at Norwalk / Santa Fe Springs. The station option to the east of the existing station provides better connections to Metrolink, but has operational restrictions because of the sharp curves entering the station and fails to meet the project purpose and need. The HST station option to the north of the existing station has better operating characteristics, but requires a long trip (approximately 1,200') to transfer to other operators at the existing station. The at-grade and north station options should be carried forward, and a more detailed analysis of the relative merits of the Fullerton and Norwalk / Santa Fe Springs HST station options carried out in the Project EIR/EIS.

4.8.6 Options Eliminated / Carried Forward

Options to be eliminated from further consideration:

- HST Station east of Existing Metrolink Station

Options to be carried forward:

- No HST Station
- HST Station north of Existing Metrolink Station

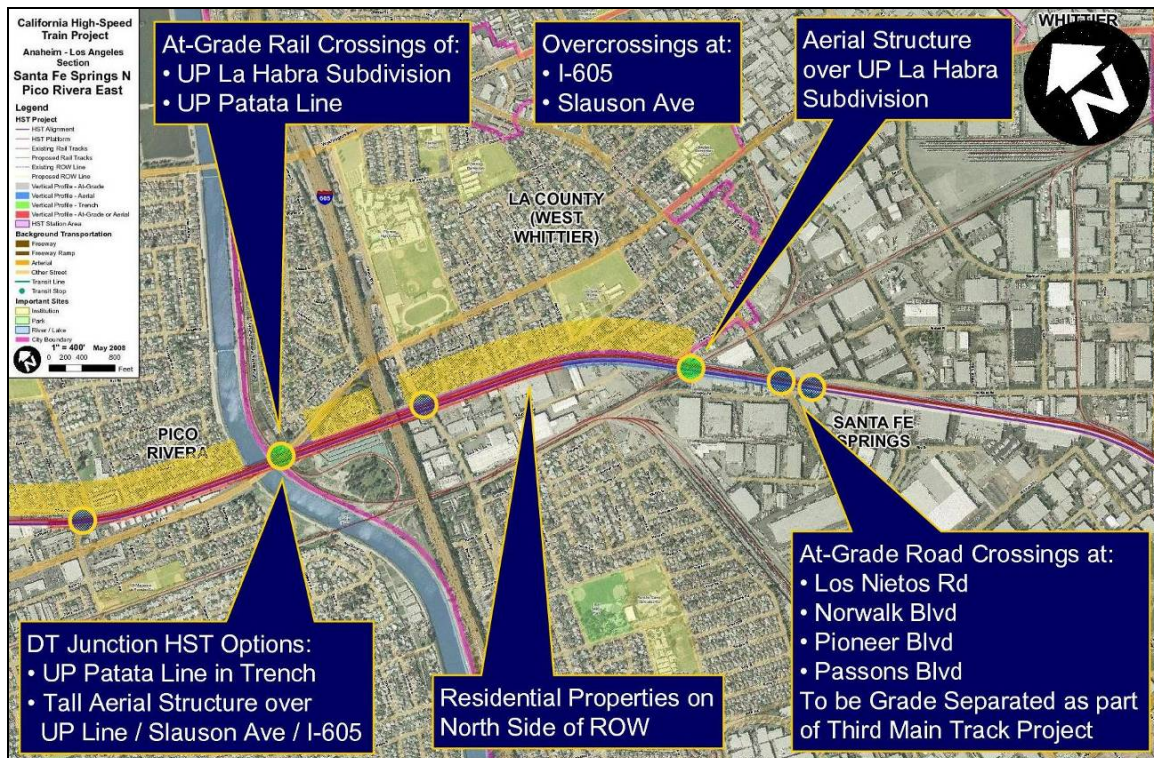
4.9 DT JUNCTION

There are currently at-grade railroad crossings at DT Junction (UP Patata Line) and CP Los Nietos (UP La Habra Subdivision) in Santa Fe Springs that will need to be removed or bypassed to allow for safe high-speed operations through the area. The configuration is made more difficult at DT Junction by the presence of the Slauson Avenue overcrossing of the San Gabriel River and railroad tracks, which lies directly above the crossing diamond and just east of the San Gabriel River.

In addition, I-605 crosses over the railroad tracks approximately ¼ mile to the east of DT Junction and a major Southern California Edison power line runs just to the east of the Patata Line. Existing at-grade highway crossings of the corridor at Passons Boulevard, Pioneer Boulevard, Norwalk Boulevard, and Los Nietos Road are planned to be grade-separated (in underpasses) as part of the Third Main Track Project. An overview of the DT Junction area is shown in Figure 4.21.

There are two options that are currently being studied for the DT Junction area to remove the current at-grade rail crossings. They are described in the following sub-sections.

Figure 4.21. DT Junction Area – Overview

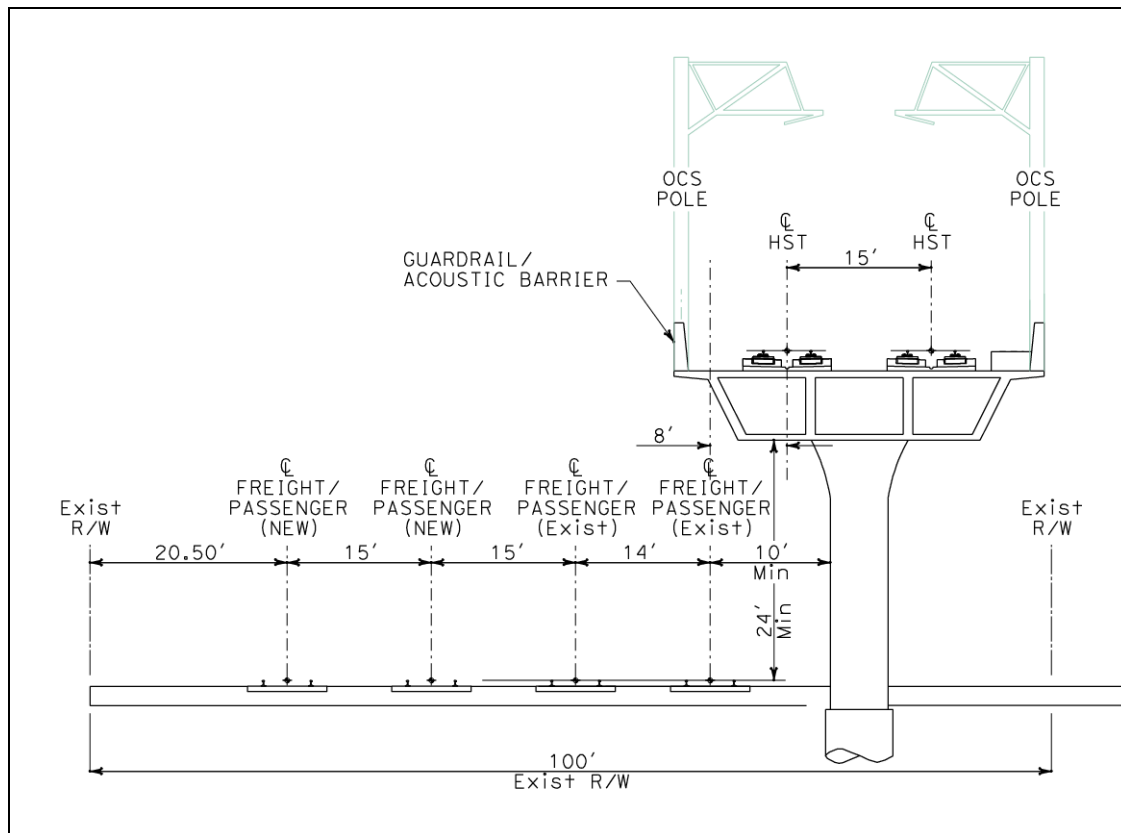


Source: AE LLC, STV Incorporated

4.9.1 La Habra Subdivision Flyover / Patata Line Trench

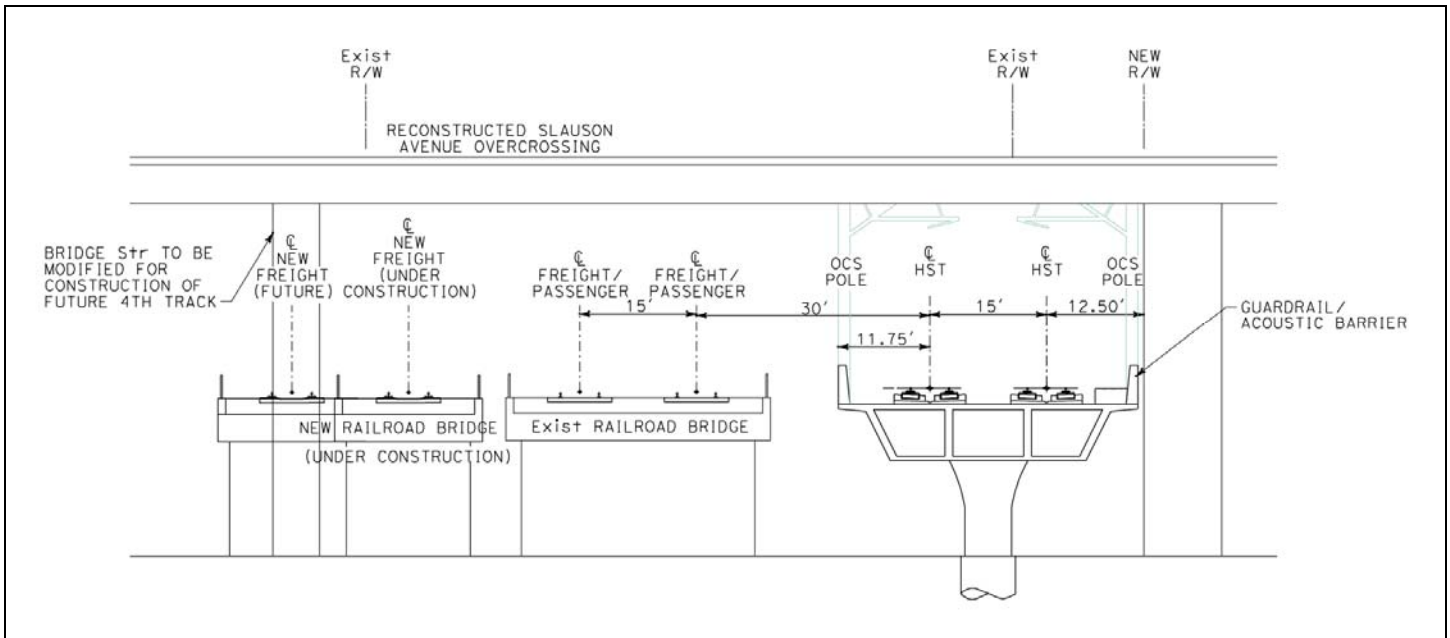
One option at DT Junction is to keep the LOSSAN corridor and HST tracks at-grade, and put the UP Patata Line in a trench. The trench would require substantial reconstruction of the existing rail junction to the south of DT Junction, and could face floodplain issues from having a large trench adjacent to the San Gabriel River. At CP Los Nietos (the crossing of the UP La Habra Subdivision), the design that is being pursued is an HST flyover of the UP line. A typical cross-section for this option at the La Habra Subdivision is shown in Figure 4.22, with a typical section for this option under the Slauson Avenue Bridge shown in Figure 4.23. Plan and profile drawings for this option are shown on Sheets 43-46 in Appendix E.

Figure 4.22. Typical Cross-Section – DT Junction Area – La Habra Subdivision Aerial Structure



Source: STV Incorporated

Figure 4.23. Typical Cross-Section – DT Junction Area – At-Grade Option

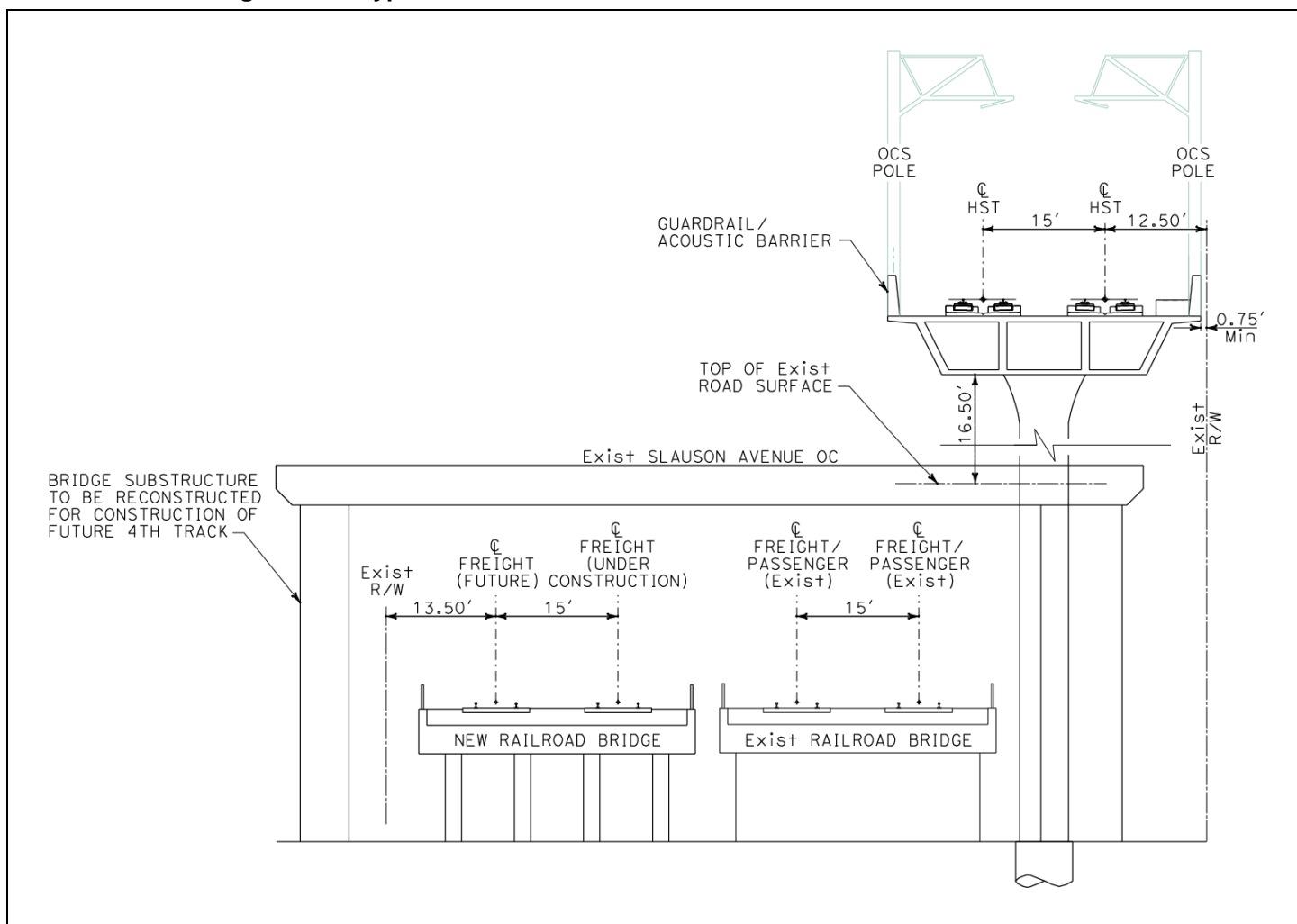


Source: STV Incorporated

4.9.2 Tall Aerial Structure

A second option at DT Junction would be to put the HST alignment on an aerial structure. This structure would run through the entire DT Junction area, passing over the UP La Habra Subdivision, I-605, Slauson Avenue, the UP Patata Line, and the San Gabriel River. The structure would need to be approximately 65' high to pass over I-605 and Slauson Avenue. The typical cross-section for this option is identical to the other option at the La Habra Subdivision (as shown in Figure 4.22). It transitions to the higher structure over I-605 and Slauson Ave, as shown in Figure 4.24. Plan and profile drawings for this option are shown on Sheets 88-93 in Appendix E.

Figure 4.24. Typical Cross-Section – DT Junction Area – Tall Aerial Structure



Source: STV Incorporated

4.9.3 Evaluation Table – DT Junction Area Options

Evaluation Measure	La Habra Subdivision Flyover / Patata Line Trench	Tall Aerial Structure
Ridership / Revenue Potential	No difference between options.	
Intermodal Connections	No stations proposed in this subsection.	
Capital Costs	Less significant structures will make this option less expensive than the tall aerial structure	Long, tall aerial structures are more expensive than smaller structures for other options.
Operating Costs	No difference between options.	
Operations Issues	No major operations issues	
Station Area Development Potential	No stations proposed in this subsection.	
Consistency with Other Planning Efforts	No difference between options.	

Evaluation Measure	La Habra Subdivision Flyover / Patata Line Trench	Tall Aerial Structure
Constructability	Likely issues with replacing at-grade UP line with trench. May require modifications to existing Slauson Avenue bridge.	No major constructability issues other than complicated logistics will result in disposing of the earth removed during construction activities. If the earth removed is loaded into a train for hauling to a disposal site, a loading facility and new temporary industrial track will be needed. This loading facility may require additional ROW to construct and operate. It will also have significant noise, vibration and light impacts to adjacent properties. If the earth removed is hauled away on truck, there will be significant roadway, traffic levels and noise impacts.
Displacements / Property Access Impacts	No major ROW takes would be necessary.	
Station Area Traffic Impacts	No HST stations are proposed at this subsection location.	
Waterways / Sensitive Habitat Areas	There is a potential flood plain impact of a trench next to the San Gabriel River. The San Gabriel River has potential sensitive habitat that could be impacted by a HST crossing.	Extra attention needed at San Gabriel River crossing.
Cultural Resources	There are older SF residential uses on the north side of the LOSSAN corridor north of Los Nietos Rd. An aerial structure could have a potential impact on cultural resources in this area. There is a minor potential for impacts to cultural resources by putting the Patata Line in a trench.	There are older SF residential houses on the north side of the LOSSAN corridor within the DT Junction area. An aerial structure could have a potential impact on cultural resources in this area by changing the historic visual context of the surrounding landscape.
Parklands	There are no parklands within the DT Junction area that would be affected.	
Agricultural Lands	There are no agricultural lands in the DT Junction area.	
Noise / Vibration	There a potential for noise and vibration impacts during construction and operation to the SF residential neighborhood located on the north side of LOSSAN corridor.	There a potential for noise and vibration impacts during construction and operation to the SF residential neighborhood located on the north side of LOSSAN corridor.
Visual / Scenic Resources	An aerial structure at the La Habra Subdivision would have the potential to impact visual and scenic resources in the SF residential neighborhood on the north side of the LOSSAN corridor.	A tall aerial structure would be highly visible within the surrounding residential community, and would have potential impacts by its sheer size and visibility, by blocking views, and by casting shadows onto surrounding residential properties particularly during the fall and winter months.
Geologic / Soil Constraints	There are no known geologic or soils constraints in the DT Junction area.	
Hazardous Materials	There is a potential that underground contamination from the industrial uses on the south side of the LOSSAN corridor within the DT Junction area could impact construction of aerial or at-grade HST tracks.	

4.9.4 Conclusions

The DT Junction options have similar impacts in most categories. The trench option at DT Junction can utilize the most existing infrastructure, but will require a major change in operations in the DT Junction area (especially for the UP) and a difficult excavation process. The tall aerial option will require a massive aerial structure with visual and noise impacts, but have few impacts otherwise. Both alternatives should be carried forward to the next stage of study, with additional study given to the implications for the UP at DT Junction and the size and construction staging for the tall aerial structure.

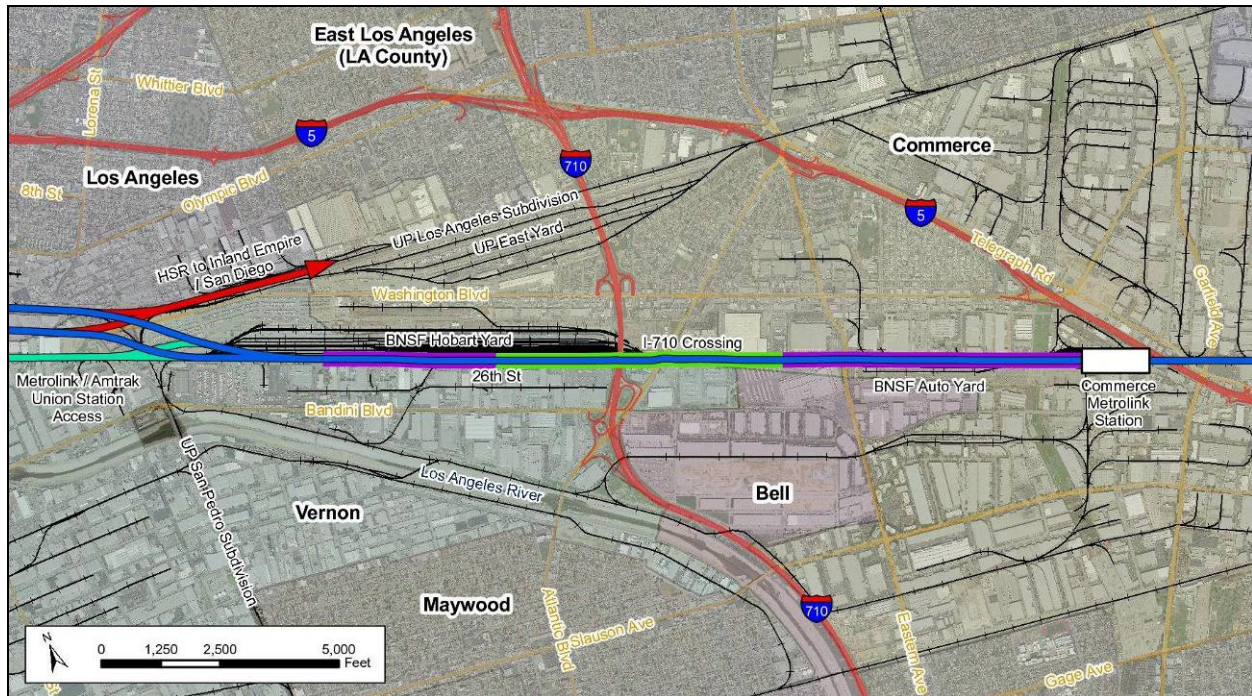
4.9.5 Options to be Carried Forward

- La Habra Subdivision Flyover / Patata Line Trench
- Tall Aerial Structure

4.10 COMMERCE / VERNON RAIL YARDS

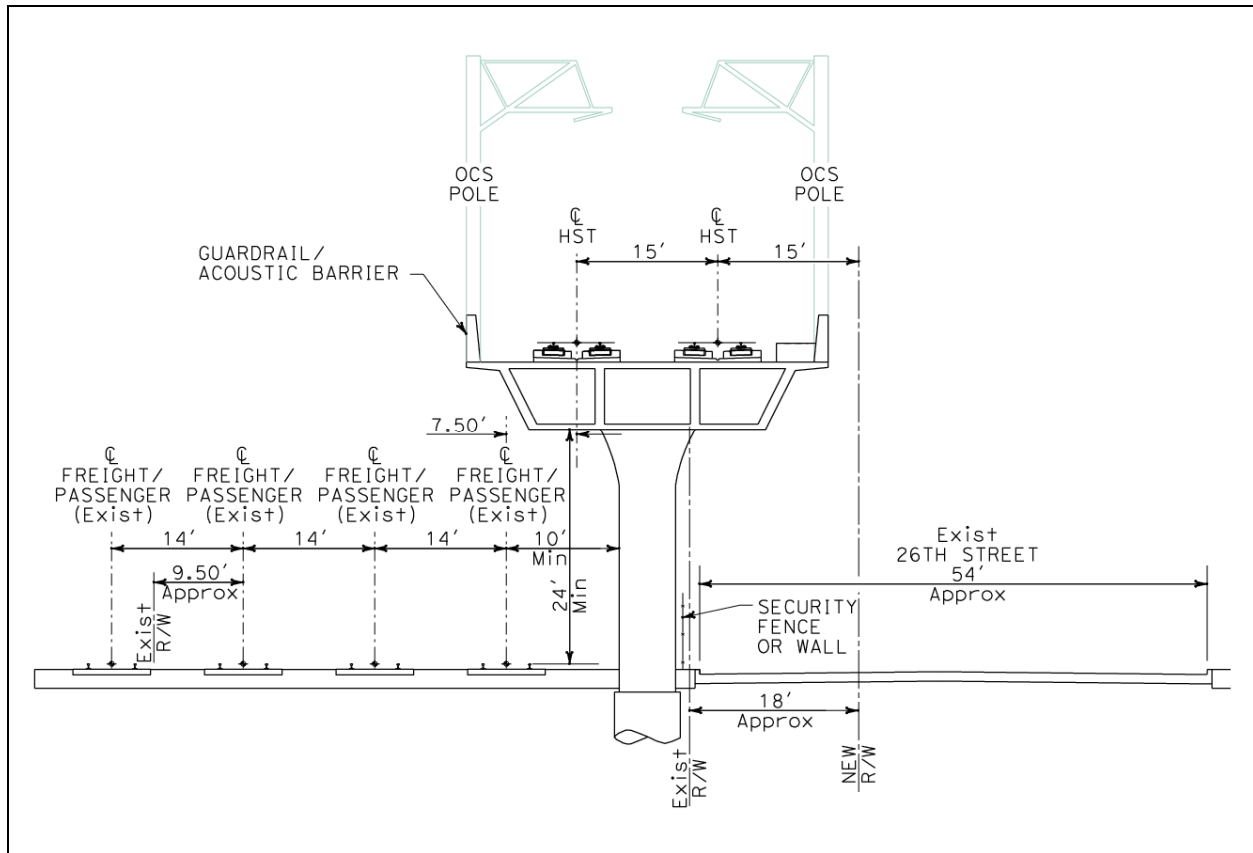
There are many freight rail tracks, yards, and spurs along the LOSSAN corridor through the industrial cities of Commerce, Bell and Vernon. In addition, the BNSF Hobart Yard and East 26th Street present major horizontal constraints for the existing LOSSAN corridor. The typical at-grade configuration discussed in Section 3.6.3 would cut off access to the important freight rail uses and businesses along E. 26th Street, and is not feasible for this section. Instead, an aerial structure is used from approximately the Commerce / Montebello city limits through Commerce, Bell, and Vernon to carry HST and other passenger trains over these constraints. An overview of the area is shown in Figure 4.25. The typical cross-section for this subsection of the project is shown in Figure 4.26. Plan and profile drawings for the alignment through this area are shown on Sheets 29-37 in Appendix E.

Figure 4.25. Commerce / Vernon Rail Yards – Overview



Source: AE LLC, STV Incorporated

Figure 4.26. Typical Cross-Section – Commerce / Vernon Rail Yards



Source: STV Incorporated

4.11 INTERSTATE 710

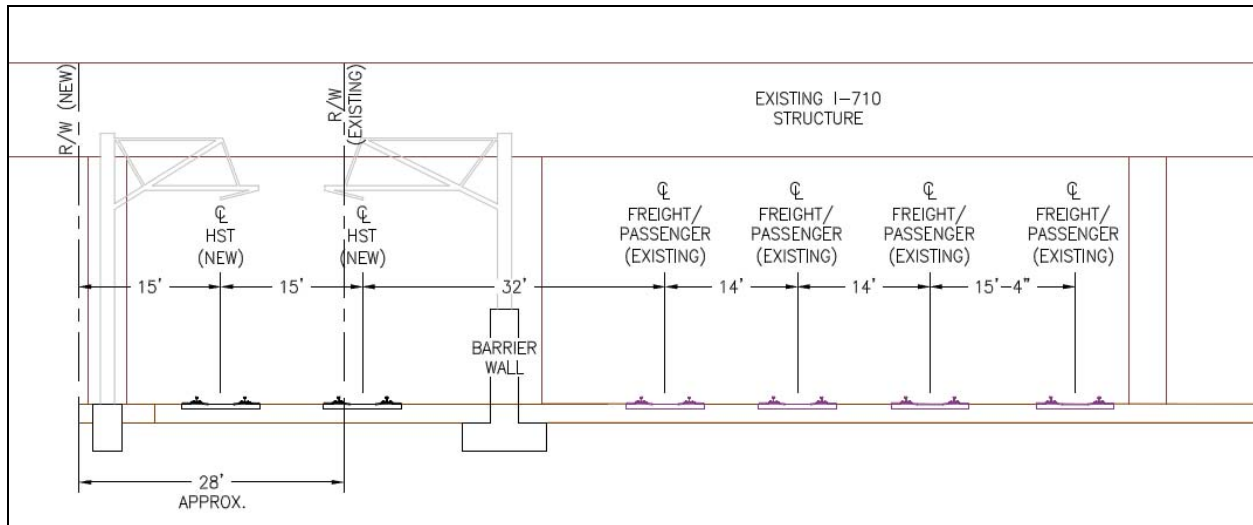
The many freight rail tracks, yards, and spurs along the LOSSAN corridor through the industrial cities of Commerce and Vernon, along with the BNSF Hobart Yard and East 26th Street present major horizontal constraints for the existing LOSSAN corridor. The typical configuration for the HST project through these cities is an aerial structure to minimize impacts to the other uses below, as discussed in Section 4.10. At Interstate 710, the freeway passes over the existing LOSSAN corridor tracks, and is located in the path of the aerial structure. Two options are investigated at the I-710 crossing.

The I-710 South project is currently undergoing environmental reviews. It includes new general purpose and truck lanes, and a large interchange near the HST crossing in Vernon to provide truck access into the rail yards. The I-710 Project is being led by Metro and Caltrans. A major design coordination effort between the HSR and I-710 projects is necessary in order to accommodate the goals of both projects without impacting the other.

4.11.1 At-Grade

One option is to go underneath I-710. This would require several thousand feet of ROW takes, and the demolition and realignment of East 26th Street (which was recently widened and extended). A typical cross-section for this option is shown in Figure 4.27.

Figure 4.27. Typical Cross-Section – I-710 – At-Grade Option

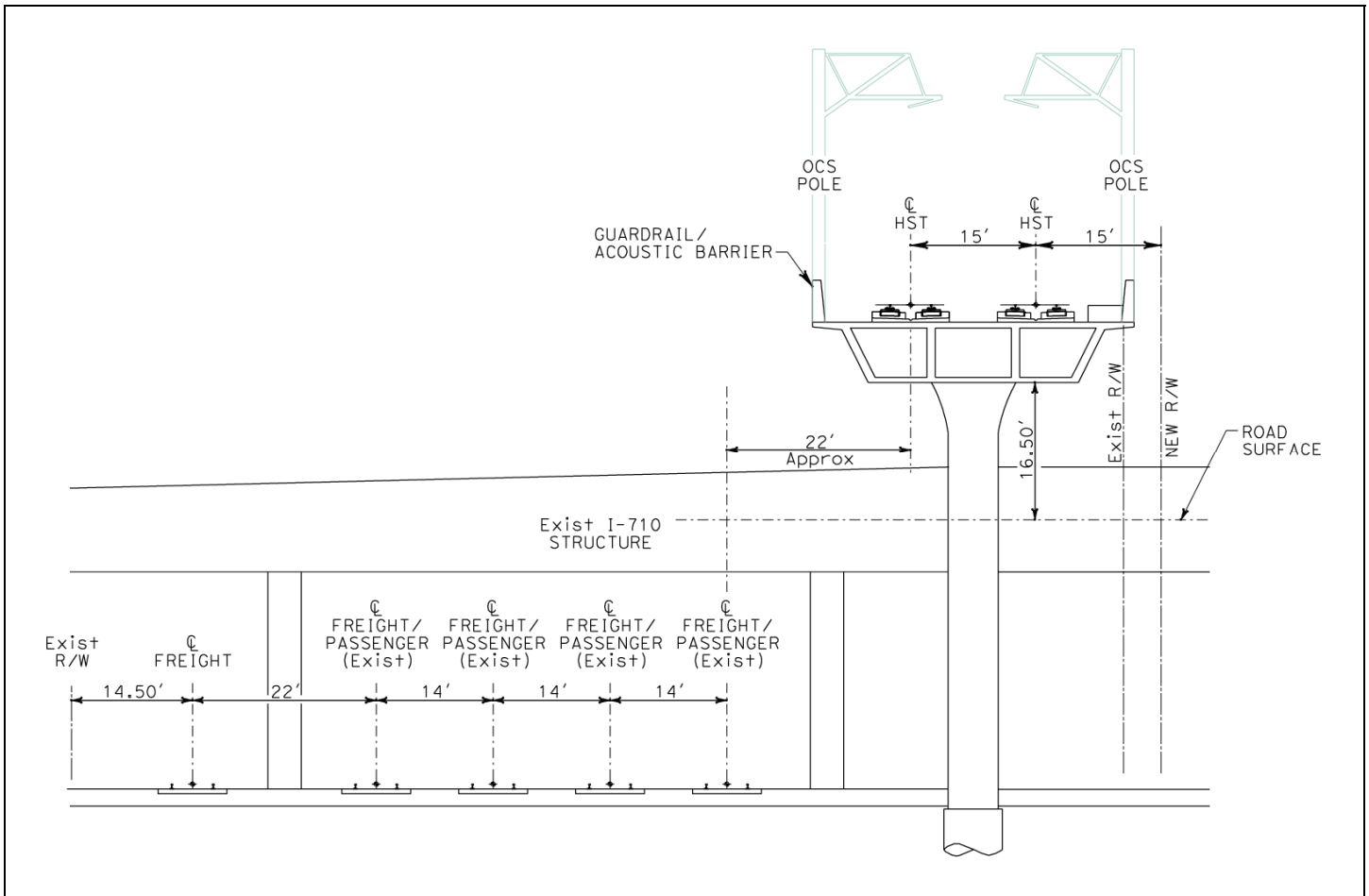


Source: STV Incorporated

4.11.2 Tall Aerial Structure

The other option at I-710 is to go over the top of the existing structure. This will require a taller aerial structure than typical, and may interfere with the freeway expansion plans described previously. A typical section for this option is shown in Figure 4.28. Plan and profile drawings for the option are shown on Sheets 31-33 in Appendix E.

Figure 4.28. Typical Cross-Section – I-710 – Tall Aerial Option



Source: STV Incorporated

4.11.3 Evaluation Table – I-710 Options

Evaluation Measure	At-Grade	Tall Aerial Structure
Ridership / Revenue Potential	No difference between options.	
Intermodal Connections	No stations proposed in this subsection.	
Capital Costs	Lower costs for at-grade construction, but large costs to relocate 26 th Street	Higher costs for tall aerial structure.
Operating Costs	No difference between options.	
Operations Issues	No major operations issues	
Station Area Development Potential	No stations proposed in this subsection.	
Consistency with Other Planning Efforts	No difference between options.	
Constructability	Significant impacts to recently widened and extended 26th Street, including new overpass over Atlantic Boulevard.	No impacts expected.
Displacements / Property Access Impacts	Constructing HST tracks at-grade through this section of the LOSSAN corridor would cause significant impacts to the recently widened and extended 26 th Street, and on the businesses on the south side of the street which use it for access. The potential displacements and access impacts would occur between Atlantic Blvd. in the south to approximately Indiana St. in the north.	Constructing a tall aerial structure for the HST tracks would result in minimal impacts to property in this area of the LOSSAN corridor.

Evaluation Measure	At-Grade	Tall Aerial Structure
Station Area Traffic Impacts	No HST stations are proposed at this subsection location.	
Waterways / Sensitive Habitat Areas	There are no waterways or sensitive habitat areas within the I-710 area. No impacts to these resources would occur.	
Cultural Resources	There are no cultural resources within the I-710 area that would be affected.	
Parklands	There are no parklands within the I-710 area that would be affected.	
Agricultural Lands	There are no agricultural lands in the DT Junction area.	
Noise / Vibration	There is a low potential for noise and vibration impacts in the I-710 area of the LOSSAN corridor due to the heavy industrial nature of the land uses.	
Visual / Scenic Resources	There is a low potential for visual / scenic resource impacts in the I-710 area of the LOSSAN corridor due to the heavy industrial nature of the land uses.	
Geologic / Soil Constraints	There are no known geologic or soils constraints within the I-710 area.	
Hazardous Materials	There is a potential that underground contamination from the industrial uses on the south side of the LOSSAN corridor within the I-710 area could impact construction of aerial or at-grade HST tracks.	

4.11.4 Conclusions

Numerous businesses along 26th Street would be displaced by an at-grade alignment and impacted during construction. The businesses along 26th Street include a jeans company, a trucking company, Exide Technologies battery recycling, two plastics companies, a warehouse for a beer bottle manufacturing operation, Bandini Fertilizer, Clorox and others. In addition, an at-grade configuration would result in the reconstruction of the recently completed Atlantic Boulevard Bridge. Given these constructability issues and ROW impacts, the at-grade option is not considered a reasonable alternative and is eliminated from further consideration.

4.11.5 Options Eliminated / Carried Forward

Options to be eliminated from further consideration:

- At-Grade

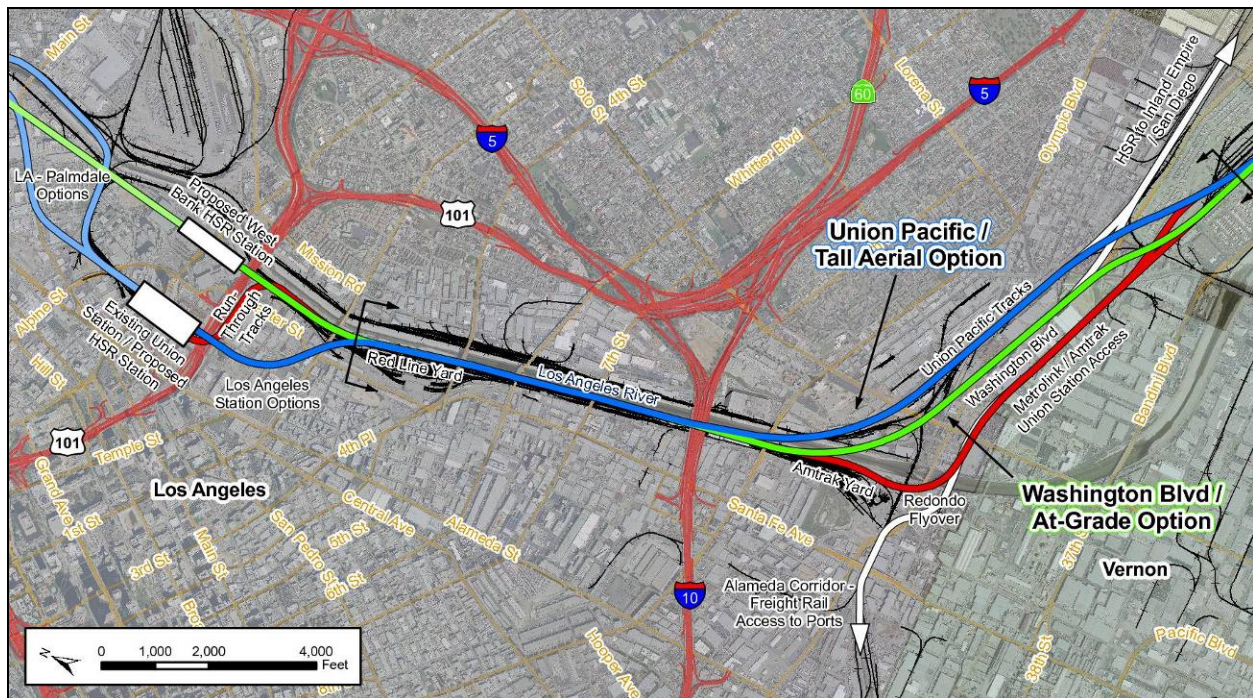
Options to be carried forward:

- Tall Aerial Structure

4.12 HOBART YARD / LOS ANGELES RIVER

Between Hobart Yard and the Los Angeles River, at-grade options are not feasible given the extensive existing transportation infrastructure in the area, including important freight rail mainlines and yards. In addition, a junction with the San Diego – Los Angeles HST section is planned for this area. The HST alignment does not follow the existing LOSSAN corridor through this area, as it includes a low-speed curve across the Los Angeles River. Instead, there are two possible options, as discussed in the following subsections. An overview of the area is shown in Figure 4.29.

Figure 4.29. Hobart Yard / Los Angeles River Area Overview



Source: AE LLC, STV Incorporated

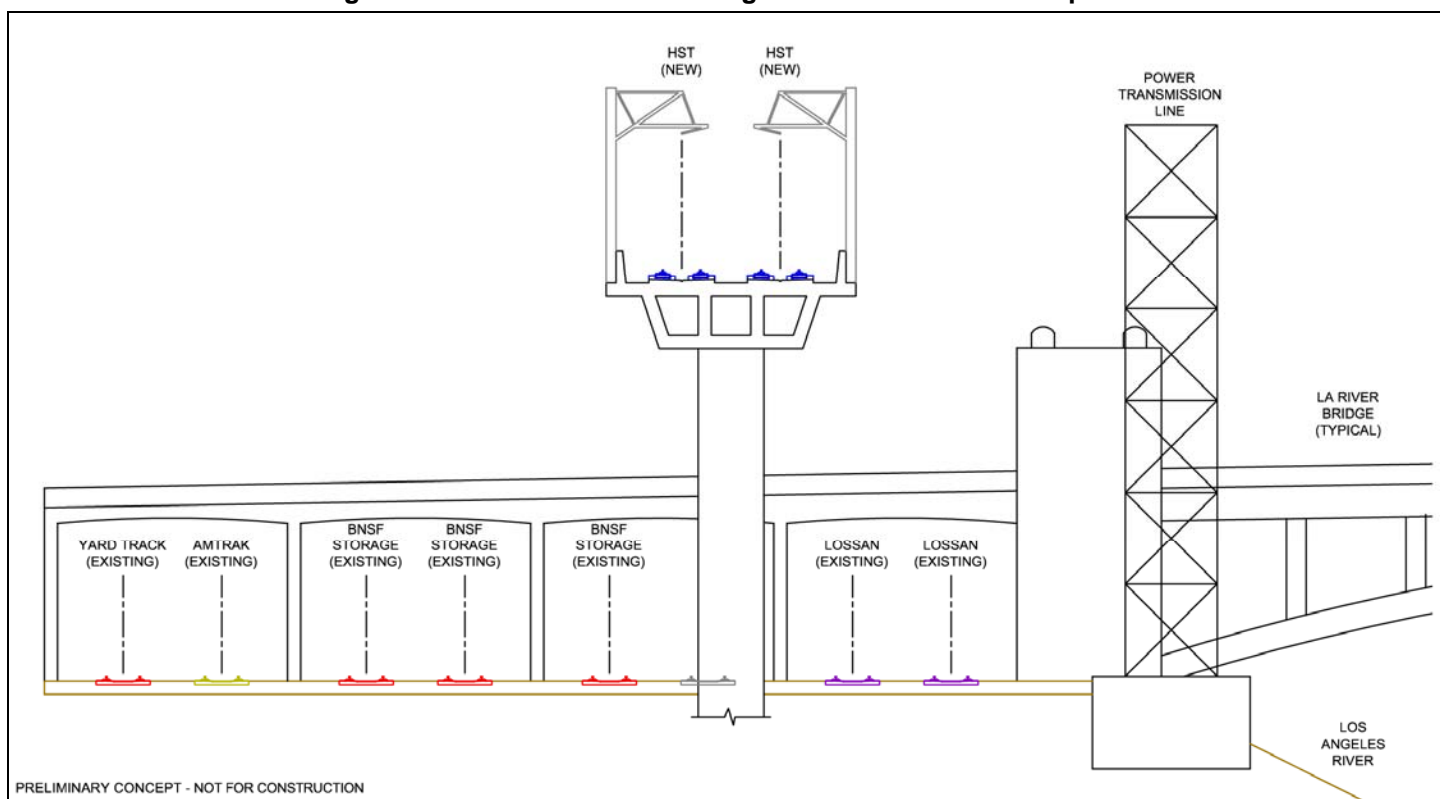
4.12.1 Union Pacific / Tall Aerial Option

One option is to have the HST tracks diverge from the LOSSAN corridor at the eastern end of Hobart Yard, and transition to the Union Pacific Los Angeles Subdivision alignment on an aerial structure. North of the junction with the San Diego HST line, the option transitions to a tall aerial alignment along the Los Angeles River. This takes it over the existing historic Los Angeles River bridges, as shown in Figure 4.30.

4.12.2 Washington Boulevard / At-Grade Option

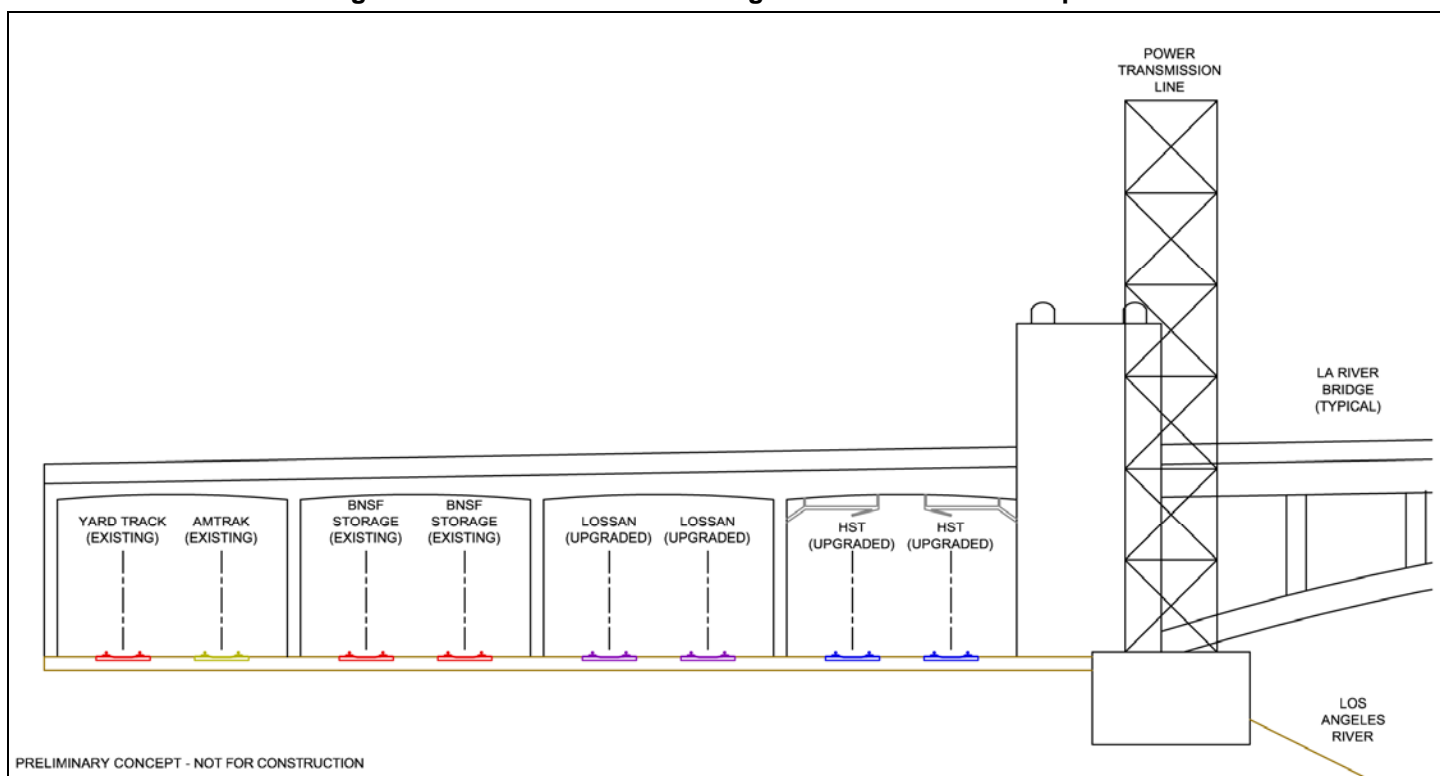
The other option examined is to have the HST tracks diverge from the LOSSAN corridor at the eastern end of Hobart Yard and transition to a Washington Boulevard alignment. North of the junction with the San Diego HST line and flying over the Los Angeles River, the option transitions to an at-grade configuration along the west bank of the river. It is able to fit underneath the historic Los Angeles River bridges, as shown in Figure 4.31. Only the Washington Boulevard alignment is able to transition to the at-grade alignment along the Los Angeles River because of horizontal clearance issues with existing railroad tracks and bridges along the river. Plan and profile drawings for this option are shown on Sheets 22-29 in Appendix E.

Figure 4.30. Hobart Yard / Los Angeles River – Tall Aerial Option



Source: STV Incorporated

Figure 4.31. Hobart Yard / Los Angeles River – At-Grade Option



Source: STV Incorporated

4.12.3 Evaluation Table – Hobart Yard / Los Angeles River Options

Evaluation Measure	Union Pacific / Tall Aerial	Washington Blvd / At-Grade
Ridership / Revenue Potential	No difference between options.	
Intermodal Connections	No stations proposed in this subsection.	
Capital Costs	Larger capital costs given substantial aerial structure along Los Angeles River.	Lower capital costs given at-grade construction along Los Angeles River.
Operating Costs	No difference between options.	
Operations Issues	No major operations issues	
Station Area Development Potential	No stations proposed in this subsection.	
Consistency with Other Planning Efforts	No difference between options.	
Constructability	Difficult construction above / adjacent to UP Mainline. Requires take of one BNSF storage track along Los Angeles River.	Difficult construction above / adjacent to Washington Blvd. Requires take of two BNSF storage tracks along Los Angeles River.
Displacements / Property Access Impacts	ROW takes would be required for transitions from the LOSSAN corridor to the UP corridor and from the UP corridor to the Los Angeles River corridor. The required property takes would be industrial uses. A ROW purchase from BNSF (storage tracks) would also be required.	ROW takes would be required for transitions from the LOSSAN corridor to the Washington Boulevard corridor and from the Washington Boulevard corridor to the Los Angeles River corridor. The required property takes would be industrial uses. ROW purchase from BNSF (storage tracks) would also be required.
Station Area Traffic Impacts	No HST stations are proposed at this subsection location.	
Waterways / Sensitive Habitat Areas	The aerial structure would span the Los Angeles River, a concrete channel, just south of Olympic Blvd. No impacts to the river bed would occur. There are no sensitive habitats in this area of the HST corridor.	An at-grade bridge would span the Los Angeles River, a concrete channel, just north of Washington Blvd. No impacts to the river bed would occur. There are no sensitive habitats in this area of the HST corridor.
Cultural Resources	<p>There would be significant visual impacts to the historic Los Angeles River bridges. The historic bridges that the HST corridor would crossover are the Olympic Blvd. Bridge (1925), the Seventh St. Bridge (1910/1927), the Sixth St. Bridge (1932), the Fourth St. Bridge (1931), and the First St. Bridge (1929). The aerial structure would span the historic bridges, but would not cause any direct changes to the bridge structures.</p> <p>There is a potential that underground archaeological resources could be unearthed during excavation activities.</p>	<p>The at-grade HST corridor would pass under the historic bridges that span the Los Angeles River. The historic bridges that the HST corridor would cross under are the Olympic Blvd. Bridge (1925), the Seventh St. Bridge (1910/1927), the Sixth St. Bridge (1932), the Fourth St. Bridge (1931), and the First St. Bridge (1929). The HST tracks would be replacing BNSF storage tracks that currently cross under these historic bridges. The at-grade HST tracks would not cause any direct changes to the bridge structures.</p> <p>There is a potential that underground archaeological resources could be unearthed during excavation activities.</p>
Parklands	There are no parklands within this area that would be affected.	
Agricultural Lands	There are no agricultural lands within this area that would be affected.	
Noise / Vibration	There is a low potential for noise and vibration impacts in the area north of Hobart Yard due to the heavy industrial nature of the land uses.	
Visual / Scenic Resources	There would be significant visual impacts to the historic Los Angeles River bridges. The historic bridges that the HST corridor would crossover are the Olympic Blvd. Bridge (1925), the Seventh St. Bridge (1910/1927), the Sixth St. Bridge (1932), the Fourth St. Bridge (1931), and the First St. Bridge (1929). The aerial structure would span the historic bridges, but would not cause any direct changes to the bridge structures.	The at-grade HST corridor would pass under the historic bridges that span the Los Angeles River. The historic bridges that the HST corridor would cross under are the Olympic Blvd. Bridge (1925), the Seventh St. Bridge (1910/1927), the Sixth St. Bridge (1932), the Fourth St. Bridge (1931), and the First St. Bridge (1929). The HST tracks would be replacing BNSF storage tracks that currently cross under these historic bridges. The at-grade HST tracks would not cause any direct changes to the bridge structures.
Geologic / Soil Constraints	There are no known geologic or soils constraints within the area north of Hobart Yard.	
Hazardous Materials	There is a potential that underground contamination from the industrial uses within the area north of Hobart Yard that could impact construction of aerial or at-grade HST tracks.	

4.12.4 Conclusions

The Union Pacific / Tall Aerial option is hampered by its inability to transition to an at-grade alignment along the Los Angeles River (vertical profile issues). This means that it must stay aerial for its entire length from Hobart Yard to Los Angeles Union Station, including the Los Angeles River corridor that is crossed by a number of historic bridges. A new, tall aerial structure will need to be added above the existing bridges, imposing major visual impacts to these culturally significant structures. The Washington Boulevard / At-Grade alignment, on the other hand, can transition to an at-grade configuration along the Los Angeles River. Both options require the taking of one or more tracks along the Los Angeles River currently used by the BNSF to store empty container wells. A separate technical memorandum, the *BNSF Storage Track Relocation Tech Memo*, details the options for relocating the tracks.

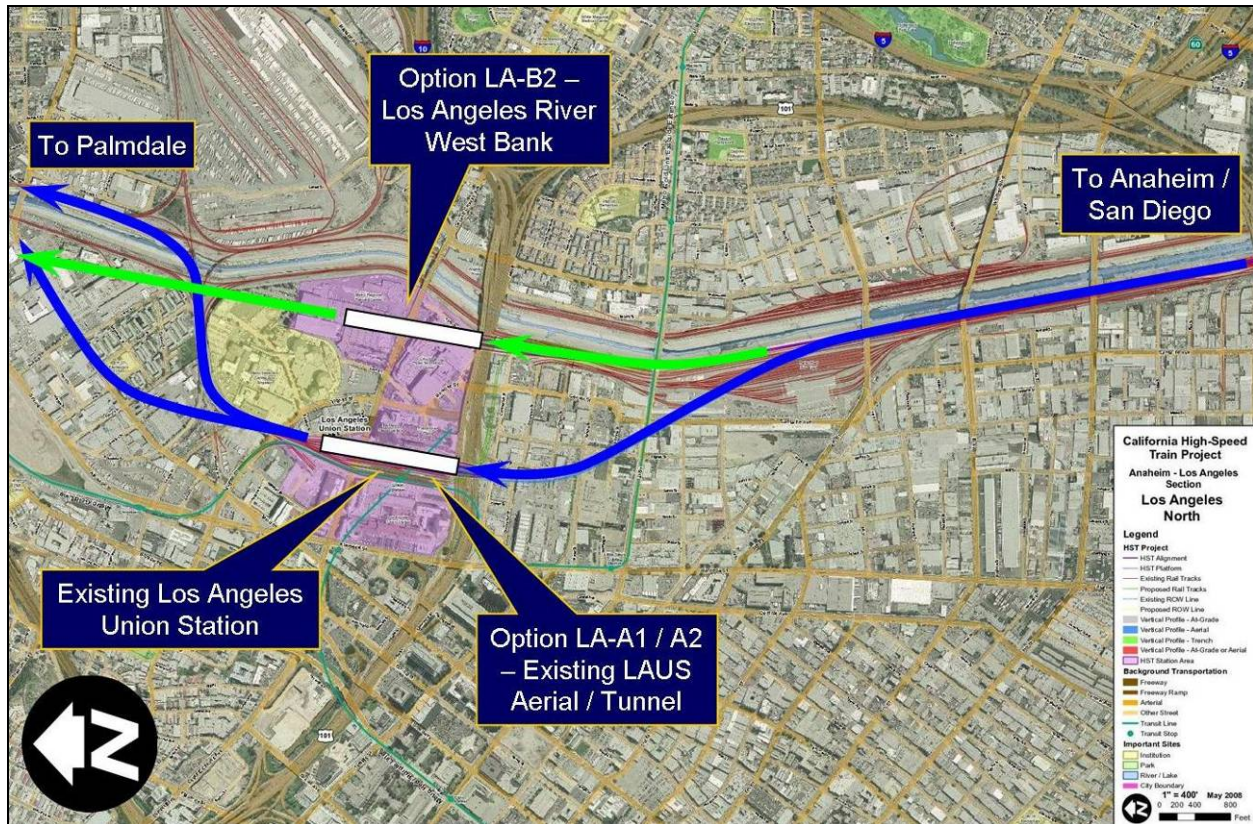
Given its cultural resources and visual impacts, it's recommended that the Union Pacific / Tall Aerial Option be eliminated from further consideration and the Washington Boulevard / At-Grade Option be advanced through the preliminary design and environmental review process.

4.13 LOS ANGELES STATION

Los Angeles Union Station (LAUS) currently serves as the transportation hub for the Los Angeles region, serving Amtrak intercity trains, Metrolink commuter trains, Metro Red and Purple Line subway trains, Metro Gold Line light rail trains, and a variety of local and regional bus services. Union Station will serve as the northern terminus of the A-LA HST Section, with connections to the north and east provided by other sections of the statewide HST system.

The HST alignment does not follow the existing Los Angeles to San Diego (LOSSAN) Passenger Rail Corridor into Union Station, as it includes many low-speed curves and loops into the station from the north. Instead, the project diverges from the existing LOSSAN corridor along the Los Angeles River to follow a new alignment into Union Station from the south. The neighborhood south of Union Station has undergone significant redevelopment in the years since the program-level environmental analysis was completed and presents many constraints. An overview of the Los Angeles Union Station is shown in Figure 4.32.

Figure 4.32. Los Angeles Union Station Area – Overview



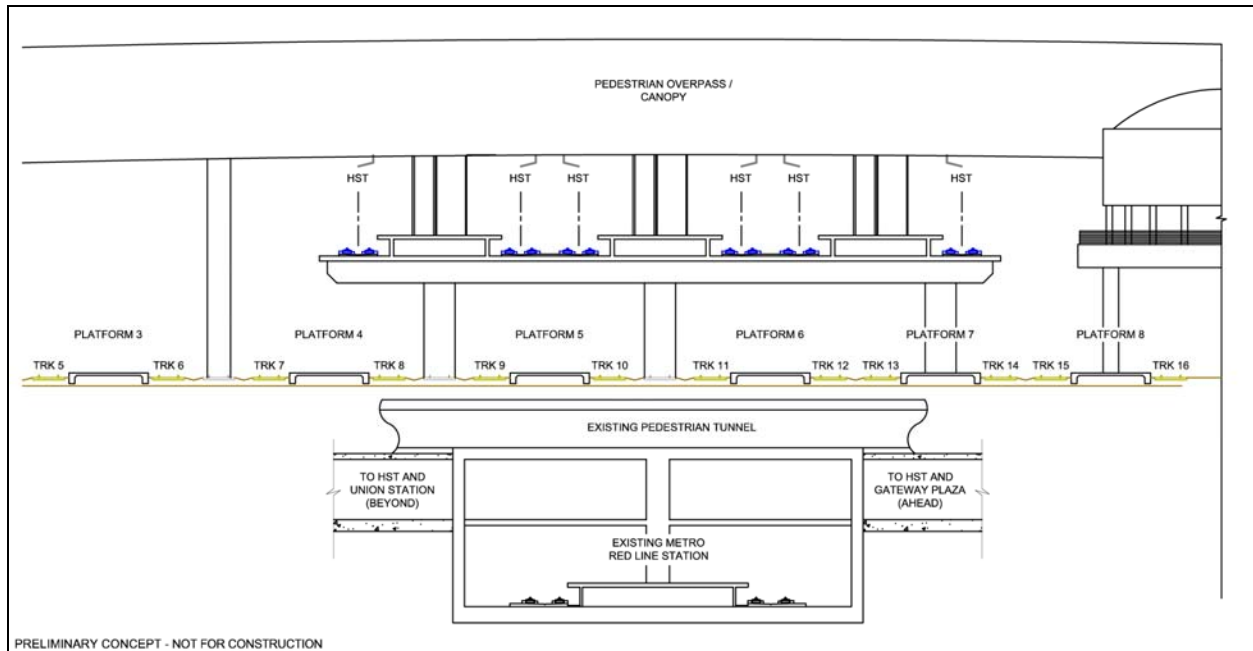
Source: AE LLC, STV Incorporated

Three options are examined in the following subsections. For further detail on Los Angeles Union Station issues, see the *Los Angeles Union Station HST Station Option Evaluation Technical Memorandum*.

4.13.1 Aerial HST Station above Existing LAUS

LAUS Option A1, the station location selected for Los Angeles Union Station in the Program EIR/EIS, is located approximately 30 feet above the existing station tracks at Union Station. The station includes 6 tracks and three platforms, and connects to the other amenities at LAUS. A typical cross-section for the station (including a conceptual station canopy) is shown in Figure 4.33.

Figure 4.33. Typical Cross-Section – Aerial HST Station above Existing LAUS

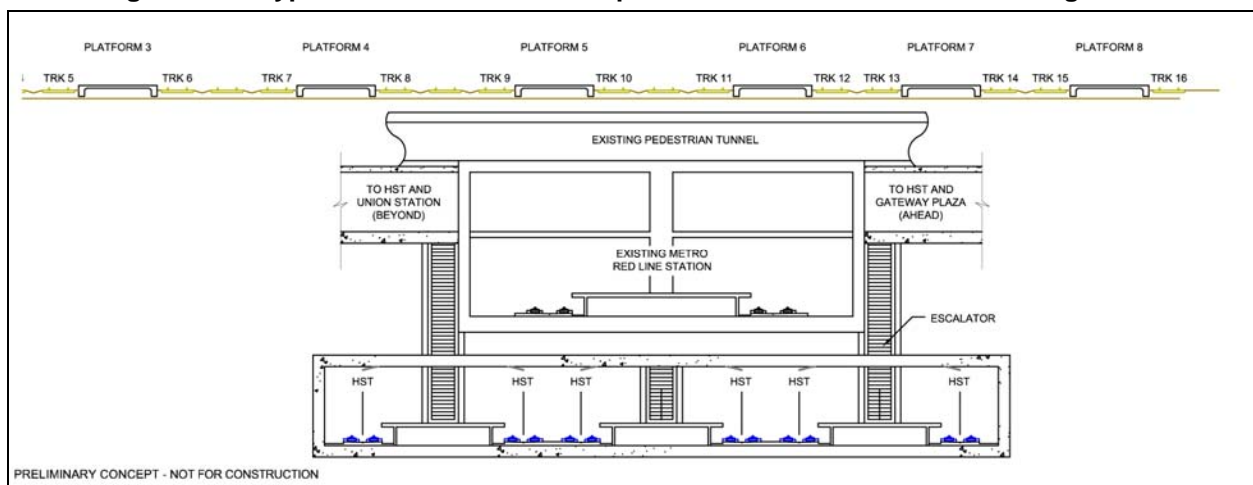


Source: STV Incorporated

4.13.2 Deep Tunnel HST Station below Existing LAUS

Given the potential impacts of the aerial Union Station option and its approaches, an underground option has also been examined. This option locates the HST tracks and platforms in a deep tunnel configuration underneath the existing Union Station and Metro Red / Purple Line subway station. A typical cross-section for this configuration is shown in Figure 4.34.

Figure 4.34. Typical Cross-Section – Deep Tunnel HST Station below Existing LAUS



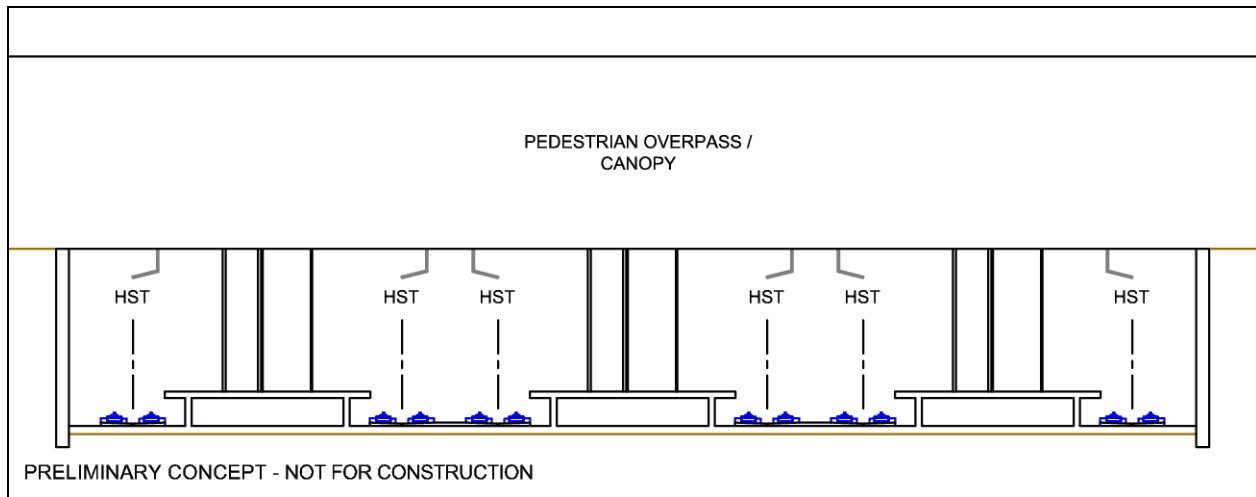
Source: STV Incorporated

4.13.3 Shallow Trench HST Station on LA River West Bank

A HST station alternative on the West Bank of the Los Angeles River could be built very close to ground level, likely a cut-and-cover / trench station slightly below grade. Station amenities would be located in a new structure on the site of the City of Los Angeles' C. Erwin Piper Technology Center (Piper Tech) and

Metro's Regional Rebuild Center (RRC) site. A typical cross-section of the station (including a conceptual station canopy) is shown in Figure 4.35.

Figure 4.35. Typical Cross-Section – LA River West Bank Station



Source: STV Incorporated

4.13.4 Evaluation Table – Los Angeles Station Options

Evaluation Measure	Aerial Station above Existing LAUS	Deep Tunnel Station below Existing LAUS	LA River West Bank Station
Ridership / Revenue Potential	No difference between options.		
Intermodal Connections	Amtrak / Metrolink / Gold Line tracks will be one level directly below HSR platforms (at-grade). Metro Red / Purple Line will be two-levels down (below-grade). Issues are mainly related to vertical circulation (escalators, elevators, etc).	Metro Red Line will be one level above; Amtrak / Metrolink / Metro Gold Line will be two (2) levels above. Circulation issues will mainly be vertical (escalators, elevators, etc).	Union Station connections to other lines are approximately 1,200 – 1,700 feet from HSR station. Vertical circulation elements may traverse part of this distance. Moving walkways / people mover may be needed.
Capital Costs	Approx. \$590 million	Approx. \$2,366 million	Approx. \$506 million
Operating Costs	Operating costs comparable to West Bank option, less than Deep Tunnel option.	Highest operating costs to run tunnel equipment.	Operating costs comparable to Aerial option, less than Deep Tunnel option.
Operations Issues	Construction above active railroad tracks will require significant coordination with Metrolink / Amtrak during construction period.	No operations issues foreseen.	Will require construction beside / below existing Metrolink / Amtrak tracks along LA River.
Station Area Development Potential / Consistency with Other Planning Efforts	Existing Union Station and Alameda District Plans identify joint development opportunities around Union Station property.		ROW takes may create coordinated development opportunities, including large parcel that the PiperTech building currently occupies and the area between LAUS and the proposed West Bank station.
Constructability	A HST station could be built above active station tracks, where knockouts above ground level could accommodate tracks and platforms; Approach options will need significant demolition of existing structures and cross many streets; transport of materials, hazardous materials.	A large mining shaft would have to be located close to Union Station in order to remove subterranean material and soil and reach a depth (100 feet) to construct a HST station, pedestrian tunnel and vertical circulation facilities. A potential mitigation strategy would involve the disposal of excavated materials via long haul to some distant disposal location to be determined. In addition, the mine shaft would have	Will require railroad coordination and property takes at Piper Tech and RRC sites, but otherwise isolated from surrounding communities; constructability of a trenched HST station is not considered a significant project challenge.

Evaluation Measure	Aerial Station above Existing LAUS	Deep Tunnel Station below Existing LAUS	LA River West Bank Station
		<p>to be dropped in close proximity to a location with sufficient space to stockpile soil and materials excavated during intensive mining and construction operations. Given the dense built environment around Union Station, there is no obvious place where mining operations of this scale will not result in local impacts to traffic circulation and access to Metro property bounded by Cesar Chavez, Alameda, Vignes and the 101 freeway.</p> <p>Additionally, the horizontal width required for a dome to accommodate new platforms, portals, 6 tracks, 3 platforms, underground station, vertical access to feed down to the new platforms, new utilities, and connection to existing passage way leading to union station is extensive. It may not be feasible to construct a substructure (including all foundation structures as drilled shaft, excavation, backfilling, support of excavation, footing, columns) that adequately supports the underground Red Line station above the platforms.</p>	
Displacements / Property Access Impacts	Construction and operation of a HST Station can be accommodated on existing Union Station property. The approaches will need significant ROW to allow for the construction of the HST tracks, with extensive displacement of existing uses and the potential for access issues at other existing properties. Just south of First St. the HST aerial structure would veer northwest and then turn to the north, and would require the take of approximately five industrial / commercial buildings and other vacant properties.	A below-grade HST Station can be constructed under the existing station with minimal additional ROW needed for both the station and the approaches. Underground ROW easements would be required for the approaches. Property takes would be required for the portal and the staging area.	A full take of the City of Los Angeles' PiperTech and the relocation of Metro's RRC. Metro is also in construction on the Union Bus Division at the south end of the RRC property just north of Cesar Chavez Avenue. The alignment north of a West Bank HST Station also may result in a partial take of the Los Angeles County Detention Center.
Station Area Traffic Impacts	The HST Station would introduce large numbers of new vehicle trips within the LAUS area at the parking structure.		
Waterways / Sensitive Habitat Areas	The HST Station and approaches would be elevated above the LA River floodplain. There are no sensitive habitat areas within the LAUS area.	The HST Station and approaches would be located below flood level of LA River, flooding risks would be avoided by flood-proofing techniques designed to protect ventilation and portal structures. There are no sensitive habitat areas within the LAUS area.	The HST Station and approaches are located adjacent to LA River and possibly below the existing river bottom, which would require additional flood-proofing during construction and operation phases. There are no sensitive habitat areas within the LAUS area.
Cultural Resources	An aerial HST Station at LAUS and would have an aerial structure above the Los Angeles River historical bridges would have a potential significant impact to the bridges and to LAUS itself.	An underground HST Station and approaches would have a potential to affect buried archaeological resources in a culturally sensitive area.	A HST Station at the West Bank location would have a potential significant impact to the historical bridges south of the station.
Parklands	The crossing of the LA River could have an effect on the LA River Revitalization Plan.	The HST Station and approaches would be underground and not affect any City parks.	Locating the HST Station on the West Bank of the LA River would have a potential affect on the LA River Park. Locating the HST Station next to the LA

Evaluation Measure	Aerial Station above Existing LAUS	Deep Tunnel Station below Existing LAUS	LA River West Bank Station
			River could provide for a new gateway and development opportunities near these areas of the LA River.
Agricultural Lands	There are no agricultural lands within this area that would be affected.		
Noise / Vibration	The HST aerial structure would pass through an industrial / commercial area immediately south of LAUS. Uses that about on the ROW would be exposed to noise and vibration affects during construction and operation.	During construction there would noise and vibration effects in the area of the portal and the staging area. Once the HST tracks are underground and at the underground station there would be no noise impacts. There would be the potential for vibration affects to the uses located above the tunnel during construction and operation.	The construction and operation of a HST Station along the west bank of the Los Angeles River would have a small potential for noise and vibration affects to the surrounding industrial uses.
Visual / Scenic Resources	The aerial station and its elevated approaches are highly visible within surrounding communities. There are industrial and commercial uses close to the aerial ROW and they would have a direct view of the aerial structures. There are also residential uses located to the southwest and north of the ROW that would have a direct line of sight of the aerial structure and station.	An underground HST Station and approaches would not be visible and there is no potential for impacts to visual or scenic resources.	A West Bank HST Station would be a new aesthetic presence along the LA River. There are mainly industrial / commercial uses adjacent to the area, and there is little potential for impacts to visual / scenic resources.
Geologic / Soil Constraints	There are no known geologic or soils constraints within the area of LAUS.	While there are no known geologic or soils constraints within the area of LAUS, digging a tunnel can encounter potential problems.	There are no known geologic or soils constraints within the area of LAUS.
Hazardous Materials	There is a potential that underground contamination from the industrial uses within the LAUS area that could impact construction of aerial Station and HST tracks.	There is a potential that underground contamination from the industrial uses within the LAUS area that could impact construction of an underground station and HST tracks.	There is a potential that underground contamination from the industrial uses within the LAUS area that could impact construction of the station or the HST tracks.

4.13.5 Conclusions

4.13.5.1 Aerial Station above Existing LAUS

An aerial HST alignment to an elevated HST station will result in some noise/vibration issues and some community impacts. However, locating a HST station above the existing Union Station best meets pedestrian accessibility and circulation between HST and connecting Metrolink, Amtrak, Red Line, Gold Line and local fixed route bus service. This option provides equal pedestrian access to the underground option, but at significantly lower cost and less burdensome constructability overall. However, this option does trigger 106 and 4(f) and ROW issues between Union Station and I-5 heading north of Union Station.

4.13.5.2 Deep Tunnel Station below Existing LAUS

Construction of an underground HST station would be costly and extremely difficult. A large mining shaft would have to be located close to Union Station in order to remove subterranean material and soil and reach a depth (100 feet) to construct a HST station, pedestrian tunnel and vertical circulation facilities. Building a temporary support structure underneath the Red Line box that can allow for ongoing operation of all existing rail lines without affecting existing underground structures – all while allowing access to construct the HST station – is extremely challenging from a constructability standpoint.

In addition, the mine shaft would have to be dropped in close proximity to a location with sufficient space to stockpile soil and materials excavated during intensive mining and construction operations. Given the dense built environment around Union Station, there is no obvious place where mining operations of this scale will not result in significant local impacts to traffic circulation and access to Metro property bounded by Cesar Chavez Avenue, Alameda Street, Vignes Street and the 101 Freeway.

Given its major constructability issues, the Deep Tunnel option is not practicable or feasible and will not be carried further.

4.13.5.3 LA River West Bank Station

Metro's Regional Rebuild Center (RRC) is the main heavy maintenance and rehabilitation facility for Metro's 2,600 bus fleet, and the City of Los Angeles' Piper Tech building is the largest general services facility in the United States, housing over 20 individual city departments. The displacement impacts to these facilities associated with the West Bank HST station option are substantial and would represent significant disruption and relocation of city services. Metro is constructing a new bus division (Union Bus Division) on the southwest corner of Cesar E. Chavez Avenue and Vignes Street. Given Metro's plan for this area, it is expected that a West Bank HST station option that results in condemnation of the RRC and partial take of the Union Bus Division (currently under construction) would be disruptive to Metro's operations and future plans for expanded service. The LA River West Bank Station does not provide direct interconnectivity to other modes of transportation including Metro Red Line and Metrolink.

A station on the West Bank is not practicable because of the significant impacts to Metro and City of Los Angeles services and substantial costs for ROW acquisition and relocation. This alternative will not be carried forward.

4.13.6 Options Eliminated / Carried Forward

Options to be eliminated from further consideration:

- **Deep Tunnel Station below Existing LAUS**
- **LA River West Bank Station**

Options to be carried forward:

- **Aerial Station above Existing LAUS**

5.0 ANALYSIS RESULTS / CONCLUSIONS

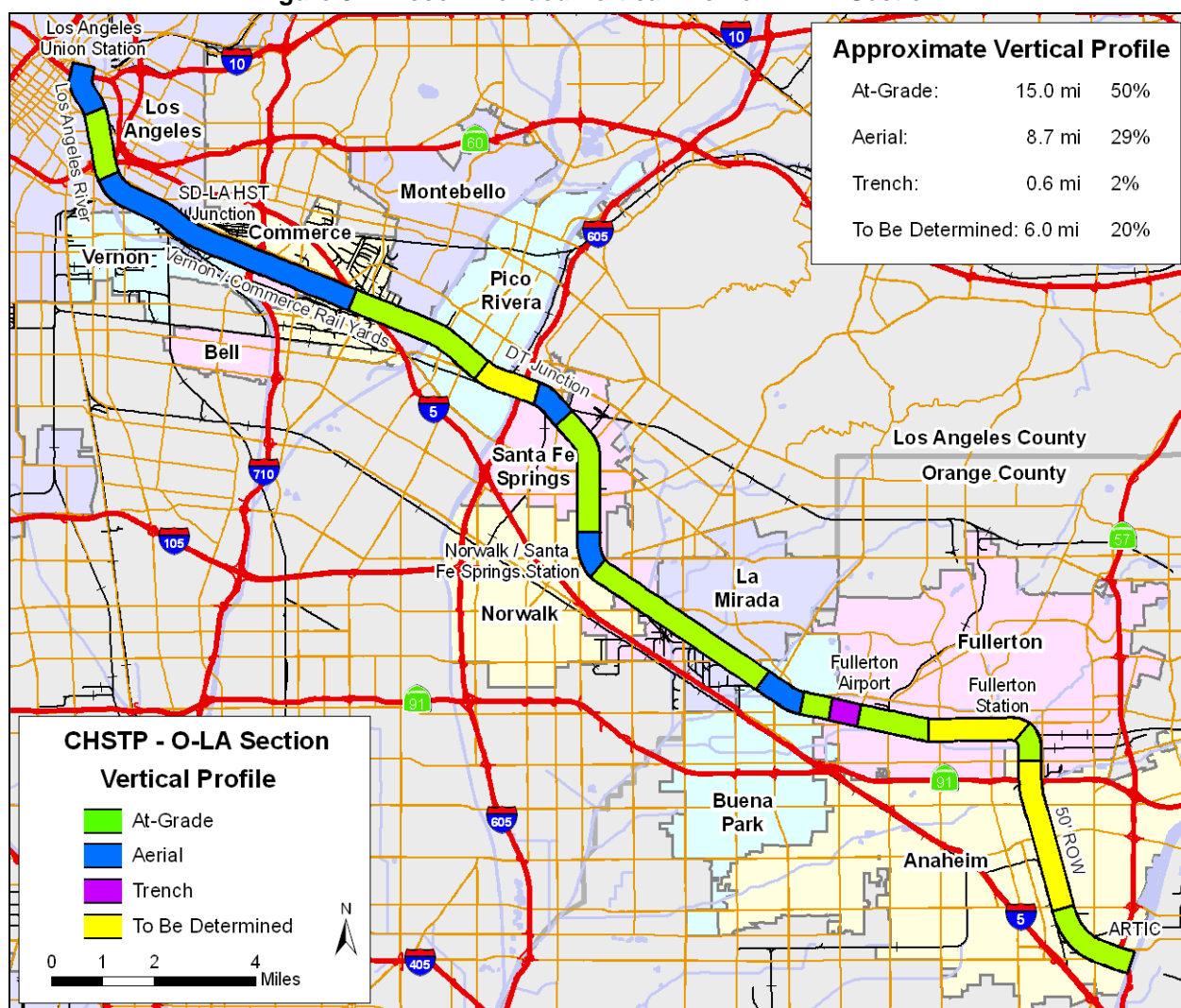
The Dedicated HST Alternative has been determined to be advanced to preliminary design and environmental review as the Build Alternative. A summary of the subsection design options studied as part of this alternative is presented in Table 5.1 listing whether they will or will not be carried forward to preliminary design and environmental review.

Table 5.1. Summary of Build Alternative Subsection Design Options

#	A-LA HST Subsection	Design Options Carried Forward	Design Options Eliminated from Further Consideration
4.1	Maintenance / Layover Facilities	<ul style="list-style-type: none"> Anaheim Area Maintenance / Layover Facility Los Angeles Area Maintenance / Layover Facility 	<ul style="list-style-type: none"> Intermediate Maintenance / Layover Facilities
4.2	ARTIC	<ul style="list-style-type: none"> 6-Track, 2-Platform At-Grade Station 	<ul style="list-style-type: none"> Existing Anaheim Station
4.3	Anaheim	<ul style="list-style-type: none"> At-Grade Deep Tunnel 	<ul style="list-style-type: none"> Aerial Cut-and-Cover Tunnel
4.4	Fullerton Station	<ul style="list-style-type: none"> At-Grade – No HST Station Aerial HST Station 	<ul style="list-style-type: none"> Deep Tunnel HST Station
4.5	Fullerton Airport	<ul style="list-style-type: none"> HST Tracks in Trench 	<ul style="list-style-type: none"> HST Tracks At-Grade
4.6	Buena Park Metrolink Station	<ul style="list-style-type: none"> HST Tracks south of Existing Station 	<ul style="list-style-type: none"> HST Tracks Aerial
4.7	La Mirada Rail Yards	<ul style="list-style-type: none"> HST Tracks north of Existing Tracks 	<ul style="list-style-type: none"> HST Tracks south of Existing Tracks
4.8	Norwalk / Santa Fe Springs Station	<ul style="list-style-type: none"> No HST Station HST Station north of Existing Station 	<ul style="list-style-type: none"> HST Station east of Existing Station
4.9	DT Junction	<ul style="list-style-type: none"> La Habra Subdivision Flyover / Patata Line Trench Tall Aerial Structure 	<ul style="list-style-type: none"> At-Grade Rail Crossings
4.10	Commerce / Vernon Rail Yards	<ul style="list-style-type: none"> HST Tracks on Aerial Structure south of Existing Tracks 	<ul style="list-style-type: none"> HST Tracks At-Grade
4.11	Interstate 710	<ul style="list-style-type: none"> Tall Aerial Structure 	<ul style="list-style-type: none"> At-Grade
4.12	Hobart Yard / Los Angeles River	<ul style="list-style-type: none"> Washington Blvd / At-Grade 	<ul style="list-style-type: none"> Union Pacific / Tall Aerial
4.13	Los Angeles Station	<ul style="list-style-type: none"> Aerial HST Station above Existing LAUS 	<ul style="list-style-type: none"> Deep Tunnel HST Station below Existing LAUS Shallow Trench HST Station on LA River West Bank

The analysis from the previous sections results in a preferred vertical profile shown in Figure 5.1. Approximately half of the corridor is at-grade and one quarter aerial, with the remaining quarter under study.

Figure 5.1. Recommended Vertical Profile – A-LA Section



Once the recommendations of this Alternatives Analysis are adopted, an updated Project Description will be prepared to document the latest configuration for the project.

APPENDIX A. ALTERNATIVE ANALYSIS METHODS FOR PROJECT-LEVEL EIR/EIS

APPENDIX B. CONCEPT LEVEL OPERATIONAL FEASIBILITY STUDY – ORANGE COUNTY – LOS ANGELES

APPENDIX C. PROGRAM-LEVEL SHARED-TRACK ALTERNATIVE – PLANS

APPENDIX D. EXPANDED SHARED-TRACK ALTERNATIVES – PLANS

APPENDIX E. DEDICATED HIGH-SPEED TRAIN ALTERNATIVE – PLANS

APPENDIX F. PHASE 1 SERVICE PLAN